THE

Practical Teacher

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Edited by JOSEPH HUGHES.

'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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Animal Physiology.

BY ARTHUR NEWSHOLME, M.D., AND C.S.S. (LOND.)

THE EYE.

THE eye is contained in a bony cavity, formed by the junction of several of the cranial bones. The socket in which the eyeball is set has its hollows filled up with fat, which acts as a cushion on which the eyeball can roll with ease in every direction. The eyelids are lined on their inner surface by a delicate mucous membrane, called the *conjunctiva*, which is then reflected over the surface of the eyeball as far forward as the cornea. (Fig. 63).

Fig. 63.

Diagram shewing reflection of conjunctiva over inner side of eyelids and front part of eyeball. *a*, point of reflection of conjunctiva. *c*, cornea. *l*, eyelids.

The eyelids are fringed by the eyelashes, which consist of hairs curved away from the eyeball. On the inner side of the eyelids, under cover of the conjunctiva, lie the *Meibomian follicles*, which secrete sebaceous matter, and thus keep the margins of the lids oiled, and help to prevent the tears from running over the cheeks.

The *lachrymal sac* is situated between the eyeball and the bone, at the upper and outer margin of the orbit. It is about the size of an almond, and several ducts from it pour their secretion (tears) under cover of the upper eyelid on to the free surface of the conjunctiva. By means of this secretion the conjunctiva and surface of the eye are washed and kept free from foreign particles. At the inner margin of the eye the secretion is received into a minute opening in the margin of each eyelid (punctum lachrymale), which leads into a minute duct called a canaliculus, the two ducts being continued downwards to the nose by the nasal duct.

Between the two puncta is a minute fold of the conjunctiva which is the representative of the third eyelids present in birds.

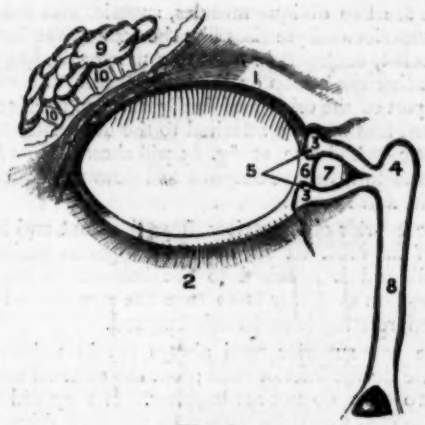


Fig. 64.

The Lachrymal Apparatus. 1, 2, cartilages of lids. 3, lachrymal canals. 4, lachrymal sac. 5, puncta lachrymalia. 6 semi-lunar fold of conjunctiva. 8, nasal duct. 9, lachrymal gland. 10, lachrymal ducts (After Gray).

The secretion of tears is greatly influenced by emotional conditions, the ducts previously described only sufficing to carry off the amount of secretion which is produced under ordinary conditions.

The eye is remarkable for the rapidity and precision with which it moves in all directions. These movements are effected by means of six slender muscles, which are connected to the bony socket at one end and to the eyeball at the other. Four straight muscles (superior, inferior, internal and external rectus) stretch from the back of the orbit to be attached in front, above, below, and on the right and left side of the sclerotic.

BRITISH MUSEUM

Fig. 65.

View of the two eyes, with optic nerves. *ch*, optic chiasma. *rr*, roots of optic nerves. *nn*, right and left optic nerves. *s*, superior rectus muscle. *i*, internal rectus. *a*, external rectus. *c*, superior oblique.

These muscles move the eye in directions indicated by their names; but inasmuch as the axis of the eye does not coincide with the axis of the orbit (fig. 65), it will be seen that the superior rectus not only turns the eye upward, but also rotates it a little on its axis toward the nose, &c.; while the inferior rectus turns the eye downward, and also rotates it a little outward. There are two oblique muscles, superior and inferior. The superior oblique rises like the recti at the back of the socket, contracts in front to a narrow tendon, then passes through a loop on the inner (nasal) side of the front part of the orbit, and finally turns on itself to run outward and become attached to the outer side of the sclerotic. A glance at fig. 65 will show that its function is to turn the eye outward and downward, rotating it on its axis inward.

The inferior oblique rises from the front and lower part of the orbit on its inner side, passes under the eyeball, and is attached to the ball on its outside. Its function evidently is to turn the eye inward and upward, rotating it on its axis outward.

The two superior recti always act in unison; so likewise do the inferior recti; but the external recti of the two eyes do not act together. If they did then the two eyes would be pulled in opposite directions, and consequently squinting and double vision would be produced. Similarly the inferior rectus of one eye does not contract at the same time as the superior rectus of the opposite eye, or dire confusion would result. The nerves governing the muscles of the eyes have become educated into producing certain combinations of movements, and only these are possible voluntarily.

The direction of the superior and inferior recti, not being exactly in the axis of vision, it is probable that the superior and inferior oblique muscles acting in conjunction with them, serve to maintain the eyeballs parallel to each other, a condition necessary for perfect vision.

The eyeball is nearly spherical in shape, and about an inch in diameter. It is pierced at its back, about $\frac{1}{10}$ inch internal to its centre by the optic nerve, which enters the orbit by a special foramen at the inner end of the orbit. The outer coat of the eye consists of a transparent anterior part, the cornea; and a posterior white part, the sclerotic.

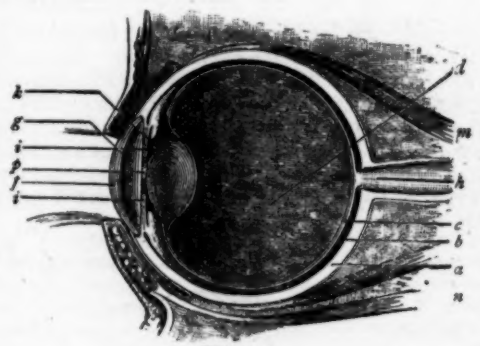


Fig. 66.

Vertical section of eyeball. *a*, sclerotic. *b*, choroid. *c*, retina. *d*, vitreous humour. *f*, cornea. *g*, aqueous humour. *h*, optic nerve. *i*, iris. *k*, crystalline lens. *m*, superior rectus muscle. *n*, inferior rectus muscle.

The *sclerotic* is a thick fibrous membrane, containing a few blood vessels, and pierced behind by the optic nerve. In front it becomes continuous with the more convex *cornea*, the two membranes merging into one another. The fibres of the cornea however are perfectly parallel, and it contains no blood-vessels. To these facts it owes its glass-like transparency. In front it is covered by epithelium, and behind by an elastic lamina; while its substance contains many branched connective tissue corpuscles. Certain minute nerve fibrils end in the cells of the corneal epithelium.

Behind the transparent cornea, the coloured *iris* can be seen. It has a circular perforation in its centre, the *pupil*, which varies in size under various conditions. The inner surface of the sclerotic is lined by the *choroid*, which resembles a cup of black velvet. It is full of blood-vessels, which supply the retina and adjacent parts. Between the vessels are delicate fibres, and a large number of dark brown pigment cells. This pigment serves to prevent reflection of rays of light from the parts of the eye on which they

fall, and thus obviates any dazzling from excess of light. In Albinos the brown pigment is absent, and consequently blurring of images is produced, and vision is more acute when the light is somewhat dim.

Fig. 67.

Diagram to illustrate the mechanism of accommodation. *a*, aqueous humour. *b*, iris. *c*, suspensory ligament of lens. *d*, ciliary muscle. *e*, ciliary processes. F. Half of lens the curve of which is adjusted for distant vision. N. Half of lens with curve adjusted for vision of near objects.

In front the choroid joins on to the ciliary processes and the iris, leaving only the minute aperture of the pupil in the cup which it forms.

The *ciliary processes* are about 70 in number, and are arranged regularly round the eye, close to the margin of the cornea and sclerotic. They consist chiefly of masses of minute blood-vessels, which bring nourishment close to the transparent lens.

The *ciliary muscle* consists of unstriped muscular fibres, these being controlled by the third nerve. It arises from the inner side of the junction of the cornea and sclerotic and passes backwards to be inserted into the choroid.

The *iris* possesses two sets of muscular fibres, circular and radiating. By the contraction of the former, the pupil is diminished; while contraction of the radiating fibres produces enlargement of the pupil. The circular fibres are governed by the third cranial nerve, the radiating fibres by the sympathetic. The pupil contracts under the influence of a bright light (by reflex mechanism) the superfluous rays of light being thus cut off. It contracts also when the eye is accommodated for near vision, the spherical aberration of the lens being in this way corrected.

The *retina* is an extremely delicate transparent layer lining the eye within the choroid. It terminates in front near the ciliary processes in a scalloped margin, called the *ora serrata*. Its average thickness is about $\frac{1}{100}$ inch, but it is much thinner on the anterior margin. It is composed of a number of layers, the more important of which are represented in fig. 68.

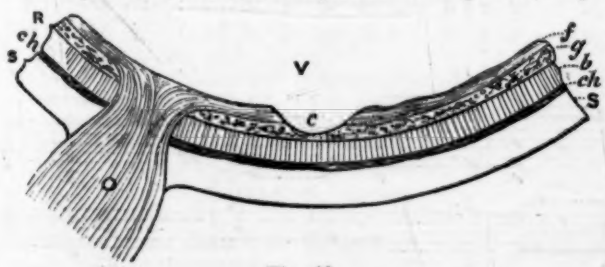


Fig. 68.

Section of retina, shewing: *o*, optic nerve. *s*, sclerotic. *ch*, choroid. *r*, retina. *c*, yellow spot. *b*, bacillary layer. *g*, granular and cellular layer. *f*, fibrous layer. *v*, vitreous (after Le Conte).

The innermost layer in contact with the vitreous humour consists of fine interlaced fibres of the optic nerve. Then come layers of granules and nucleated cells. And outermost of all, in contact with the choroid, is the bacillary layer. This consists of slender, cylindrical rods and larger cone-like bodies —known as the *rods and cones*. The rods are about $\frac{1}{3500}$ inch long, and $\frac{1}{140000}$ inch wide. The cones are shorter and wider than the rods. In the depression (fovea centralis) of the yellow spot (*c*, fig. 68) only cones are found, and here they are very small in size. Where the optic nerve enters the eye only the fibrous layer is present, and this is the *blind spot* of the eye. That this spot is insensible to light may be easily proved. The axis of the eye is always directed to the object looked at, and in this axis lies the yellow spot, while to its inner side is the point of entrance of the optic nerve. If the left eye be shut and the right eye fixed on the appended cross A, while the book is slowly moved towards and away from the eye, at a certain distance, B will dis-

appear, coming into the field again as the book is withdrawn or held still nearer. The obvious interpretation is that at a certain distance B falls on a spot internal to the axis of the eye, which is insensible to light.

About one-tenth of an inch outside the blind spot is a yellow elliptical mark, called the *yellow spot of* Sömmering, with a central depression called the *fovea centralis*. This spot is in the axis of the eye, and is the point at which rays of light are normally brought to a focus.

The fact that the point where the optic nerve enters the eye is a blind spot, shews that a special terminal organ is required to receive the impressions of light, the nerve simply serving to carry these; while the fact that the yellow spot is more sensitive to light than other parts of the retina, and is in the axis of the eye, shows that the bacillary layer, and especially the cones, are the chief agent in receiving rays of light.

The eyeball is formed by the cornea and sclerotic, the choroid and the retina. It is not hollow and empty, but filled with transparent refractive media. (Fig. 66.) There are the crystalline lens and the aqueous and vitreous humours.

The *lens* is a circular double-convex lens, about one-third of an inch in diameter, and one-sixth of an inch thick, the posterior surface being more convex than the anterior. On section it is seen to consist of a number of layers increasing in density towards the centre, each layer being formed by nucleated regularly arranged fibres. The lens is enveloped in a very thin transparent membrane, the capsule of the lens, which not only envelopes it, but continues outward as a plaited curtain to the ciliary processes of the choroid coat. The perfect transparency of the lens is necessary for distinct vision; cataract arises from its opacity.

In front of the lens, the anterior chamber is filled by the *aqueous humour*, most of which lies between the iris and the cornea, though a small portion is behind the iris, the two parts communicating through the pupil. The aqueous humour is a thin watery fluid, containing a small quantity of albumen and chloride of sodium in solution.

The *vitreous humour* forms nearly four-fifths of the whole globe of the eye. It consists of jelly-like mucous tissue, containing in its meshes a watery fluid. Probably it has a slight refracting influence on the rays of light, but its chief object is to maintain the shape and distension of the eyeball, and keep the lens at the proper distance from the retina.

THE SHEEP AND HER LAMBS.

Music by T. CRAMPTON.

Gracefully. *p*

As I walk'd o - ver the hills one day, I stopp'd and I heard a mother sheep say, "Oh! in
"The thrush may doat on her dar - lings four, But I love my lit - tle lamb - kins more." And the

KEY F. *Gracefully.* *p*

all the world there is no - thing so sweet As my lit - tle lamb with his nim - ble feet.
mo - ther sheep and her dear lit - tle one, Sweet-ly side by side lay in the sun.

C.t.

With his eye so bright, and his wool so white, Oh! he is my dar-ling, my heart's de-light.
And they went to sleep on the hill - side warm, As a child goes to sleep on his mo - ther's arm.

Sym.

f.F.

Knitting Maps.

BY MRS. J. D. HARRIS.

GENTLEMAN'S KNICKERBOCKER STOCKING.

Pins No. 15. Chamber's bell guage.

6 oz. fingering.

Cast on 30 stitches on each pin—90 *in all.* If the stitches are cast on in the old fashioned way over the thumb, it will be found to answer best, as the first row should be *firm* though not tight.

A rib in *this stocking* is knit 3, purl 2. Knit 1, purl 1, for *one* inch.

Rib for 4 *inches.*

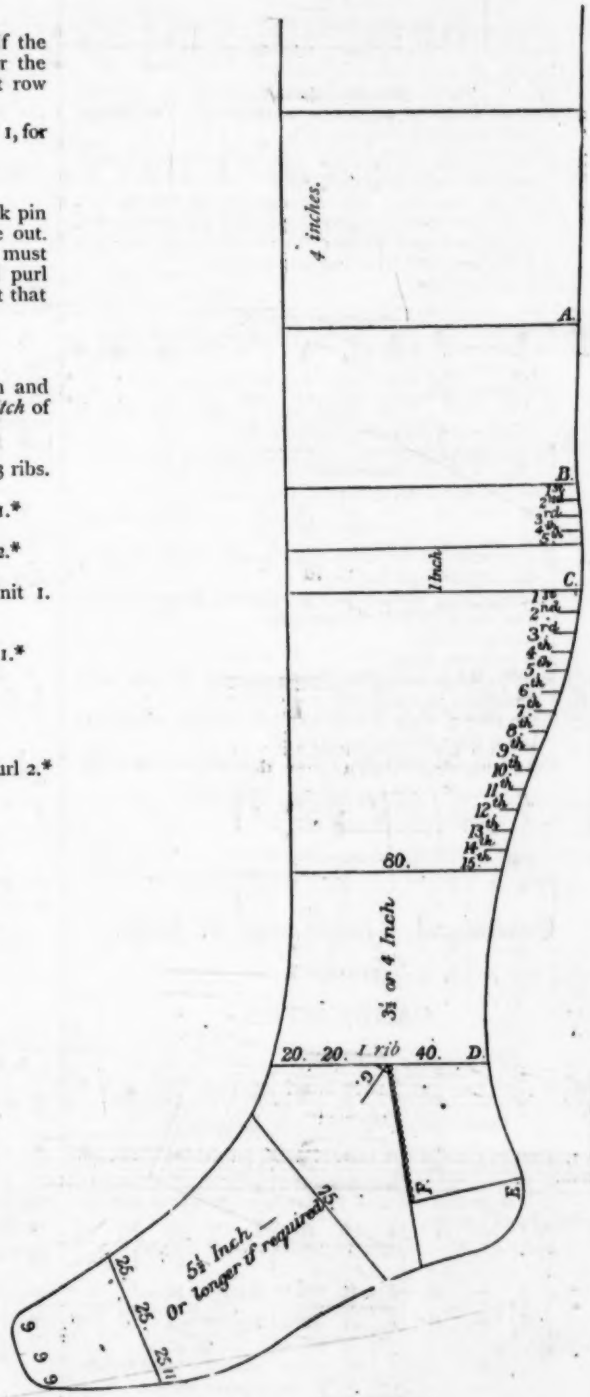
A. At the centre of one pin (which will be the back pin throughout the leg) turn the knitting inside out. This of course reverses the knitting, and you must now knit the 3 stitches that look purled, and purl the 2 that look knitted. This forms the part that turns *over* at the top of the stocking.

To increase for Calf.

B. 1st. 2 ribs. Knit 3. Purl 1. Pick up a stitch and purl it. Purl 1. (To do this pick up the *stitch* of the last round. This avoids making a hole.)
Rib the rest of the round.*
The 4 next rounds in this pin only will be 3 ribs. Purl 1.
2nd. 3 *ribs.* Pick up and purl a stitch. Purl 1.*
4 rounds, 3 ribs, purl 2.
3rd. 3 ribs. Pick up and knit a stitch. Purl 2.*
4 rounds, 3 ribs, knit 1, purl 2.*
4th. 3 ribs. Pick up and knit a stitch. Knit 1. Purl 2.*
4 rounds, 3 ribs, knit 2, purl 2.*
5th. 3 ribs. Knit 1. Pick up a stitch. Knit 1.*
This brings in one extra rib.
Rib 1 inch, or longer if required.

To reduce for Calf.

C. 1st reducing. 3 ribs. Knit 1, knit 2 together, purl 2.*
4 rounds, 3 ribs, knit 2.*
2nd. 3 ribs. Knit 2 together, purl 2.*
4 rounds, 3 ribs, knit 1, purl 2.*
3rd. 2 ribs. Purl 1, purl 2 together, purl 2.*
4 rounds, 2 ribs, knit 3, purl 4.*
4th. 2 ribs. Knit 3, purl 1, purl 2 together.*
4 rounds, 2 ribs, knit 3, purl 3.*
5th. 2 ribs. Knit 3, purl 1, purl 2 together.*
Rib 4 rounds.
6th. 2 ribs. Knit 3, purl 2 together.*
4 rounds, 2 ribs, knit 3, purl 1.*
7th. 2 ribs. Knit 3, knit 2 together, knit 2.*
4 rounds, 2 ribs, knit 6.*
8th. 2 ribs. Knit 2, knit 2 together, knit 1.*
4 rounds, 2 ribs, knit 5.*
9th. 2 ribs. Knit 1, knit 2 together, knit 2.*
4 rounds, 2 ribs, knit 4.*
10th. 2 ribs. Knit 1, knit 2 together, knit 1.*
Rib 4 rounds.
11th. 2 ribs. Knit 1, knit 2 together.*
4 rounds, 2 ribs, knit 2.
12th. 2 ribs. Knit 2 together, purl 2.*
4 rounds, 2 ribs, knit 1, purl 2.*
13th. 2 ribs. Purl 2 together, purl 1.*
4 rounds, 2 ribs, purl 2.*
14th. 2 ribs. Purl 1, purl 2 together, purl 1.*
4 rounds, 2 ribs, purl 3.*
15th. 2 ribs. Purl 1, purl 2 together.
There should be 80 stitches in all.
Rib 3½ or 4 inches, or longer if required.



Rules for Heel.

D. Add 2 ribs to each end of the heel pin—40 in all.
20 stitches on each instep pin.
(It is plain knitting for the heel, and under the foot. The instep only is ribbed.)
Knit and purl the alternate rows of the heel, being careful to slip the first stitch of each row till you have 18 loops on each side.

To turn the Heel.

E. Begin on the purl, or wrong side.
Purl 24. Purl 2 together, turn the pin.*
Slip 1. Knit 8, knit 2 together.*
Slip 1. Purl 8, purl 2 together.*
Repeat till all the stitches are taken up. You should have 10 stitches on the pin.

F. With this pin (1st heel pin) take up and knit 18 loops and add 1 rib from instep pin.
Knit the remaining ribs on one pin, all but the last. This must be knitted on to a third pin (which will be the 2nd heel pin, and take up 18 loops, and knit 5 stitches on it from the first heel pin.
Knit one round.

To reduce for Instep.

G. 1st heel-pin. Knit to within 7 of the end, knit 2 together, 1 rib.
Rib instep-pin.
2nd heel-pin. 1 rib, slip 1, knit 1; pull the slipped stitch over, knit the remainder.*
Knit 1 round between each reducing.
Repeat * till you have only 75 stitches in all.
Knit 5½ inches or longer if required.

To reduce for Toe.

H. Put 25 stitches on each pin, being careful to keep the centre from the heel.
1st heel-pin. Knit 2, knit 2 together, knit to within 4 of the end, knit 2 together.
Instep-pin ditto.
2nd heel-pin ditto.
Knit 3 rounds between each, reducing till you have 9 stitches on each pin.
Then knit 2, knit 2 together for 1 round, which will bring the stitches to 21 *in all.*
Put 11 on the front pin. Knit together and cast off.

(To be continued.)

—o—

Government Examination of Pupil Teachers.

CANDIDATES.

Arithmetic.

BOYS ONLY.

Candidates taking Subjects of Standard V.

1. Find by practice the value of 2178¾ articles @ £3 18s. 4d. each.

(1) Let us find value of 2178 articles, and then add the value of ¾ of 1 article.

			£2178 os. od. = value @ £1 each
			3
			6534 0 0 = " £3 "
10s.	½	£1	1089 0 0 = " 10s. "
5	½	10s.	544 10 0 = " 5s. "
3s. 4d.	⅓	£1	363 0 0 = " 3s. 4d. "
			2 18 9 = value of ¾ of an article
			£8533 8 9 = required answer.

2. If an iron casting that weighs 13 cwt. 1 qr. 1 lb. cost £7 14s. 8¼d., what will be the cost of one that weighs 10 cwt. 3 qrs. 11 lbs. at the same rate?

cwt. qr. lb.	cwt. qrs. lbs.	£ s. d.
As 13 1 1	: 10 3 11	:: 7 14 8¼
4	4	20
53	43	154
28	28	12
425	355	1856
106	86	4
1485	1215	7425

$\frac{5}{7425} \times 1215$ farthings $= {}^{6}\!/_{1}{}^{0}\!/_{2}{}^{7}\!/_{3} = £6\ 6s.\ 6\frac{3}{4}d.$ Ans.

3. Simplify $\frac{1}{2} + \frac{3}{5} + \frac{2}{4} + \frac{4}{5} + \frac{5}{6}$.

L. C. D = 60

$$\frac{30 + 40 + 45 + 48 + 50}{60} = \frac{213}{60} = 3\tfrac{1}{20}.$$ Ans.

4. After paying the following bill a man had enough money left to give 2½d. to each of 59 children: 3½ lbs. of tobacco @ 4½d. per oz.; 35 qts. of petroleum @ 1s. 1d. per gal.; 1½ cwt. of cheese @ 7½d. a lb.; 3 boxes of oranges, each containing 10 doz. @ 9d. per doz.; 3 cwts. 2 qrs. 8 lbs. of sugar at 3¾d. per lb. How much money had he at first?

	£ s. d.
3½ lbs. @ 4½d. per oz. = 4½d. × 56	= 1 1 0
35 qts. @ 1s. 1d. per gal. = 1s. 1d. × 8¾	= 0 9 5¾
1½ cwt. @ 7½d. per lb. = 7½d. × 168	= 5 8 6
30 doz. @ 9d. per doz. = 9d. × 30	= 1 2 6
3 cwt. 2 qrs. 8 lbs. @ 3¾d. per lb. = 3¾d. × 400	= 6 5 0
	£14 6 5¾

∴ Original sum = £14 6s. 5¾d. + 2½d. × 59 = £15 os. od. Ans.

Candidates taking Subjects of Standard VI.

1. Add together ⅝ of £5 8s. 7¾d.; $\frac{3}{11}$ of £21 12s. 2½d.; $1\frac{1}{5}$ of £10 os. 11¼d.

£ s. d.	£ s. d.	£ s. d.
5 8 7¾	21 12 2½	10 0 11¼
5	7	11
7)27 3 2¾	11)151 5 5½	15)110 10 3¾
3 17 7¾	13 15 0½	7 7 4½

£ s. d.	
3 17 7¾	
13 15 0½	
7 7 4½	
£24 19 11¾	Ans.

2. Multiply 4·59 by 40·7; and divide the result by 0·187.

4·59
40·7
3213
18360
186·813

$\frac{186{\cdot}813}{0{\cdot}187} = \frac{186813}{187}$ removing the decimal point 3 places to the right in both numerator and denominator.

187)186813(999
1683
1851
1683
1683
1683

999 Ans.

3. A rate of 3s. 1½d. on £1 of rental produces the sum of £2163 11s. 10½d. What is the rental?

As 3s. 1½d. : £2163 11s. 10½d. :: £1

12 — 480

37 — 480 halfpence

2

75 halfpence.

$$\frac{£2163\ 11s.\ 10\tfrac{1}{2}d. \times \overset{32}{\cancel{480}}}{\underset{5}{\cancel{75}}} = £13847\ 0s.\ 0d.$$ Ans.

4. Find the simple interest on £353 15s. 4d. for 3¾ years at 2½ per cent. per annum.

$$\frac{£353\ 15s.\ 4d. \times 3\tfrac{3}{4} \times 2\tfrac{1}{2}}{100} = \frac{£353\ 15s.\ 4d. \times \tfrac{15}{4}}{100}$$

$$= \frac{£357\ 15s.\ 4d. \times 3}{32} = \frac{£1061\ 6s.\ 0d.}{32} = £33\ 3s.\ 3\tfrac{3}{4}d.$$ Ans.

Candidates taking the Subjects of Standard VII.

1. In a class of 23 children, 6 were 10 years 3 months old, 5 were 10 years 7 months; 7 were 10 years 8 months; 2 were 11 years 5 months; and 3 were 12 years 5 months. What was their average age?

Yrs.	Mths.			Yrs.	Mths.
10	3	× 6	=	61	6
10	7	× 5	=	52	11
10	8	× 7	=	74	8
11	5	× 2	=	22	10
12	5	× 3	=	37	3
				23)249	2
				10	10

Ans.

2. If a shop-keeper gain 12 % by selling coffee at 1s. 2d. per lb., at what price per lb. must he sell it to gain 36 %?

As $\overset{3}{\cancel{12}}$: 100 :: $\overset{1}{\cancel{2}}$s. 2d. : buying price of coffee.

8 — 1

$$\frac{100d. \times 1}{8} = 12\tfrac{1}{2}d. = 1s.\ 0\tfrac{1}{2}d.$$

As 100 : 136 :: 1s. 0½d. : selling price of coffee.

12

12

2

25 halfpence.

$$\frac{\overset{34}{\cancel{136}} \times \overset{25}{\cancel{200}}}{\underset{4}{\cancel{100}}} = 34 \text{ halfpence} = 17d. = 1s.\ 5d.$$

3. A piece of silver lost 3½ % of its weight in being made into a tankard that weighed 1 lb. 3 oz. 2 dwt. 2 grs. What was its original weight?

As 96½ : 100 :: 1 lb. 3 oz. 2 dwts. 2 grs.

3 — 3

290 — 300

$$1\text{ lb. }3\text{ oz. }2\text{ dwts. }2\text{ grs.} \times \frac{\overset{30}{\cancel{300}}}{\underset{29}{\cancel{290}}} = 1\text{ lb. }3\text{ oz. }12\text{ dwts. }12\text{ grs.}$$

4. Find the simple interest on £275 10s. for 4½ years at 7½ %.

£275 10s.

4½

1102 0

137 15

1239 15

7½

8678 5

619 17 6

92·98 2 6

20

19·62

12

7·50

£92 19s. 7½d. Ans.

GIRLS ONLY.

Candidates taking the Subjects of Standard V.

1. Make out a bill for the following:—

	s.	d.	£	s.	d.
14¾ yds. of silk @	3	8 per yd. =	2	14	1
6¼ yds. of merino @	3	9 ,, =	1	4	4½
15½ yards of calico @	1	10 ,, =	1	8	5
6¾ yds. of crape @	2	9 ,, =	0	18	6¾
			6	5	5¾

2. If a chest of tea containing 76½ lbs. cost £12 0s. 9d., at what rate per lb. must it be retailed to gain 2½ guineas.

As 76½ lbs. : 1 lb. :: £12 0s. 9d. + £2 12s. 6d.

$$\frac{£14\ 13s.\ 3d.}{76\tfrac{1}{2}} = \frac{£14\ 13s.\ 3d. \times 2}{153} = \frac{£29\ 6s.\ 6d.}{153}$$

$$= 3s.\ 10d.$$ Ans.

3. Find the value of 206½ tons of coal @ £1 5s. 6d. per ton.

			£	s.	d.	
5s.	¼	£1	206	0	0	= value of 206 tons @ £1 each.
			51	10	0	= ,, ,, @ 5s. ,,
6d.	1/10	5s.	5	3	0	= ,, ,, @ 6d. ,,
			0	12	9	= ,, ½ ton @ £1 5s. 6d.
			£263	5	9	= ,, 206½ tons @ £1 5s. 6d.

4. By how much is the sum of ½ and ⅓ greater than their difference?

$$\tfrac{1}{2} + \tfrac{1}{3} = \frac{3+2}{6} = \tfrac{5}{6} \qquad \tfrac{1}{2} - \tfrac{1}{3} = \frac{3-2}{6} = \tfrac{1}{6}$$

$$\tfrac{5}{6} - \tfrac{1}{6} = \tfrac{4}{6} = \tfrac{2}{3}.$$ Ans.

Candidates taking the subjects of Standard VI.

1. Add together ⅜ of £1 17s. 6d., ⅘ of £1 1s. 8d., ⅞ of 3 guineas, and $\frac{5}{17}$ of 18s. 5d.

	£	s.	d.	£	s.	d.
	4	8¼				
$\frac{3}{8} \times \overset{1}{\cancel{4}}\ \overset{1}{\cancel{4}}\ \overset{1}{\cancel{7}}$		6	=	0	14	0¼
	4	4				
$\frac{4}{5} \times \overset{1}{\cancel{4}}\ \overset{1}{\cancel{4}}$		8	=	0	17	4
	7					
$\frac{7}{9} \times \overset{1}{\cancel{3}}\ \overset{1}{\cancel{3}}$		0	=	2	9	0
	1	1				
$\frac{5}{\cancel{17}} \times \overset{1}{\cancel{9}}\ \overset{1}{\cancel{18}}$		5	=	0	5	5
				£4	5	9¼.

Ans.

2. Express as decimals in the order of magnitude, each of the three following fractions:—

$$\tfrac{1}{2},\ \tfrac{1}{3},\ \frac{1\frac{1}{3} - \frac{4}{11}}{\frac{7}{11} + \frac{3}{4}}$$

$$\frac{1\frac{1}{3} - \frac{4}{11}}{\frac{7}{11} + \frac{3}{4}} = \frac{\frac{231 - 80}{336}}{\frac{7 + 9}{12}} = \frac{151}{336} \times \frac{\overset{3}{\cancel{12}}}{16} = \frac{151}{448}$$

$\frac{1}{2}$ = ·5

$\frac{1}{3}$ = ·3

$\frac{151}{448}$ = ·337053571 +

Arranged in the order of magnitude we have thus

(1st) $\frac{1}{3}$

(2nd) $\frac{1\frac{1}{3} - \frac{4}{11}}{\frac{7}{11} + \frac{3}{4}}$

(3rd) $\frac{1}{2}$

448)151·0('337053571

1344

1660

1344

3160

3136

2400

2240

1600

1344

2560

2240

3200

3136

640

448

192

3. If one ox be worth 9 sheep, and 4 oxen be worth 3 horses, what is the value of each horse, reckoning the sheep at £1 17s. 6d. each?

Since 4 oxen = 3 horses in value
∴ 1 ox = ¾ horse in value
and 1 horse = ⅓ of an ox
but 1 ox = 9 sheep
∴ 1 horse = ⅓ of 9 sheep = 12 sheep
but 1 sheep = £1 17s. 6d. in value
value of 1 horse = £1 17s. 6d. × 12 = £22 10s. 0d. Ans.

4. Find the simple interest on £475 10s. for 3 years at 2½ per cent. per annum.

£	s.
475	10
	3
1426	10
	2½
2853	0
713	5
35·66	5
20	
13·25	
12	
3·00	

£35 13s. 3d. Ans.

Candidates taking the Subjects of Standard VII.

1. Simplify $\frac{6\frac{1}{4} - 2\frac{1}{2}}{5\frac{1}{4} + 4\frac{1}{2}} \div \frac{11}{14}$

$$= \frac{4 + (\frac{1}{4} - \frac{1}{4})}{9 + (\frac{1}{4} + \frac{1}{2})} \times \frac{14}{11} = \frac{4\frac{1}{3}}{10\frac{1}{4}} \times \frac{14}{11} = \frac{\overset{9}{\cancel{39}}}{\underset{14}{\cancel{82}}} \times \frac{\cancel{14}}{\cancel{41}} \times \frac{\cancel{41}}{\cancel{25}} = \frac{9}{25}. \text{ Ans.}$$

2. The carriage of 2 cwt. 3 qrs. 14 lbs. for 126 miles cost 13s. 5d.; what will the carriage of 7 cwt. 1 qr. 16 lbs. for 140 miles cost?

2 cwt. 3 qrs. 14 lbs. : 7 cwt. 1 qr. 16 lbs. :: 13s. 5d. :
126 : 140

$$\frac{13\text{s. } 5\text{d.} \times \overset{10}{\cancel{140}} \times \overset{157}{\cancel{628}}}{\underset{63}{\cancel{126}} \times \underset{11}{\cancel{308}}} = \frac{\text{d.}\ 252770}{693} = £1\ 10\text{s. } 4\tfrac{11}{63}\text{d.} \text{ Ans.}$$

3. A gentleman bought a farm which he afterwards let for £169 13s. a year, thus realizing 4½ % on the purchase money; what did the farm cost him?

As £4½ : £169 13s. :: £100 : Ans.
20 20
90 3393

$$\frac{\overset{10}{\cancel{100}} \times \overset{377}{\cancel{3393}}}{\underset{9}{\cancel{90}}} = £3770. \text{ Ans.}$$

4. What is the average of the following fractions? ½, ⅔, ¾, ⅘, ⅚.

$$\text{The average} = \frac{\frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \frac{5}{6}}{5} = \frac{\frac{30 + 20 + 15 + 12 + 10}{60}}{5}$$

$$= \frac{\overset{29}{\cancel{87}}}{\underset{20}{\cancel{60}}} \times \frac{1}{5} = \frac{29}{100}. \text{ Ans.}$$

Grammar.

BOYS AND GIRLS.

Candidates taking the Subjects of Standard V.

Merrily rose the lark and *shook*
The dewdrop from *its* wing;
But I never marked its *morning* flight,
I never heard it *sing*.

1. Analyze the third line.

Connective—But. *Subject*—I. *Predicate*—Marked. *Object*—Its morning flight. *Extension of Predicate*—(showing time) never.

2. Parse the words in italics.

Merrily—adverb of manner modifying 'rose.'
rose—intransitive, strong verb, active voice, indicative mood, past tense, singular number, 3rd person, agreeing with 'lark.'
the—definite article limiting 'lark.'
lark—common noun, singular number, common gender, nominative case to 'rose.'
shook—transitive, strong verb, active voice, indicative mood, past tense, singular number, 3rd person, agreeing with 'lark.'
its—personal pronoun, singular, common gender, 3rd person, possessive case, attributive to 'wing.'
But—adversative co-ordinate conjunction, joining 'the lark rose' and 'I marked.'
I—personal pronoun, singular, common gender, 1st person, nominative case to marked.
never—adverb of time, modifying marked.
morning—noun used adjectively, qualifying flight.
sing—intransitive, strong verb, active voice, infinitive mood, present tense, governed by heard.

3. Make adjectives from *thought*, *man*, *faith*, *speed*, *day*, *would*, and make nouns from *black*, *human*, and *hardy*.

Adjectives:—thoughtful, manly, faithful, speedy, daily, willing.
Nouns:—blackness, humanity, hardihood.

4. Explain what is meant by an 'Extension of the Predicate,' and give an example.

An 'Extension of the Predicate' is any word or phrase which modifies the meaning of the verb constituting the Predicate.
e.g.—I saw the man 'every day,' 'in the street.i
Here we have two extensions. (1) Every day (showing time), and (2) In the street (showing place).

Candidates taking the Subjects of Standard VI.

1. They moved in tracks of *shining white*.
And, *when they reared*, the elfish light
Fell off in hoary *flakes*.
Analyze this passage.

No.	Kind of Sentence	Connective	Subject	Predicate	Object	Extension of Pred.
A	Principal		they	moved		in tracks of shining white (place)
B	Principal copulative co-ordinate with A	and	the elfish light	fell		off (place) in hoary flakes (manner)
C	Subordinate adverbial of time qualifying fell	when	they	reared		

2. Parse the words in italics in the above passage.

of—preposition showing relation between 'tracks' and 'white.'
shining—participial adjective qualifying 'white.'
white—adjective used substantively, objective case by 'of.'
when—subordinate conjunction of time joining 'the light fell' and 'they reared.'
they—personal pronoun, plural, common, 3rd person, nominative case to reared.
reared—reflexive verb (themselves is understood), weak, active, indicative, past, plural, 3rd person, agreeing with they.
fell—intransitive, strong verb, active voice, indicative mood, past tense, singular, 3rd person, agreeing with light.
off—adverb of place modifying fell.
flakes—common noun, plural number, neuter gender, objective case by 'in.'

3. Give the meaning of each of the following Latin prefixes, and give an example of the use of each :—a, ad, ob, circum, sub, de, dis.

PREFIX	MEANING	EXAMPLE	ROOT MEANING
a	from	abate	to beat *from*
ad	to	adjudicate	to give judgment *to*
ob	in the way of	obstruct	to build *in the way of*
circum	around	circumvent	to go *round*
sub	under	subterranean	*under* the earth
de	down	descend	to clamber *down*
dis	about, apart, not	dissever, dissatisfied	to cut apart, not satisfied

4. State what is meant by an adverbial sentence, and give an example.

An 'adverbial sentence' is a sentence which modifies a verb, adjective, or other adverb, *i.e.*, a sentence which does the work of an adverb.

We shall be at home *if you make an arrangement with us.* This sentence in italics is an adverbial sentence of *condition.*

Candidates taking the Subjects of Standard VII.

1. The wind had no *more* strength *than* this,
That leisurely it blew,
And made each leaf the *next to kiss,*
That close beside *it grew.*

Analyze this passage.

No.	KIND OF SENTENCE	CONNECTIVE	SUBJECT	PREDICATE	OBJECT	EXTENSION OF PRED.
A	Principal		the wind	had	no more strength	
B	Subordinate adverbial sentence of comparison to A	than	this	[is great] understood		
C	Subordinate noun sentence in apposition with 'this' in B	that	it	blew		leisurely (place)
D	Subordinate noun sentence copulative co-ordinate with C	and	[it]	made	each leaf (direct) to kiss the next (complementary object)	
E	Subordinate adjective sentence qualifying leaf (understood) in D		that	grew		close beside it (place)

2. Parse the words in italics in the above passage.

more—adjective of quantity, comparative degree, limiting strength.
than—subordinate conjunction, of comparison joining 'the wind had' and 'this is great.'
That—subordinate conjunction introducing 'it blew.'
leisurely—adverb of manner modifying 'blew.'
it—personal pronoun, singular, neuter gender, 3rd person, nominative case to 'blew.'
blew—intransitive, strong verb, active voice, indicative mood, past tense, singular, 3rd person, agreeing with 'it.'
next—adjective of quality, superlative degree, qualifying 'leaf' (understood).
to—preposition, sign of the infinitive mood.
kiss—transitive, weak verb, active voice, infinitive mood, governed by 'made.'
That—relative pronoun, singular number, neuter gender, 3rd person, nominative case to 'grew.'
close—adverb of degree modifying 'beside.'
it—personal pronoun, singular, neuter gender, 3rd person, objective case by 'beside.'
grew—intransitive, strong verb, active voice, indicative mood, past tense, singular, 3rd person, agreeing with 'that.'

3. *Ashore, besmear, perform, analyze, subscribe, surmount, evacuate.*

Arrange the prefixes in these words as Latin, English, &c.; give the force of each prefix and another instance of its use.

PREFIX	LANGUAGE	FORCE	ANOTHER EXAMPLE
a	English	on	*a*foot
be	English	intensive	*be*spangle
per	Latin	through	*per*vade
ana	Greek	up, upon	*ana*logy
sub	Latin	under	*sub*stantiate
sur	Latin 'super' through French	over	*sur*charge
e	Latin	out	*e*licit

4. What is meant by a '*noun in apposition*,' '*an adverb of degree*,' a '*noun sentence*'? Give sentences in illustration of each.

When a noun is placed by the side of another noun to explain or give further information about that noun, the explanatory noun is said to be in *apposition* with the other.

e.g., John is a *man*, William *the Conqueror*.

I refer to my friend the *doctor*.

The words underlined are in *apposition*.

An adverb of degree is one which shows the amount or intensity of a quality.

He walks *very* quickly. He looks *extremely* intelligent.

A noun sentence is one which may be used in all the parts of a sentence in which a noun can be used.

e.g., I know *that he is wrong*. Object.

That he did this is certain. Subject.

It is a shame *that he is not rewarded*. *Apposition*.

Geography.

Candidates taking the subjects of Standard V.

1. The mountain ranges of Europe run east and west as a rule. Name some ranges which follow this rule, and some which do not follow it, and give a particular account of one of those named.

(*a*) *Following the rule*:—Pyrenees, Alps, Carpathians, Balkans.

(*b*) *Not following the rule*:—Scandinavian Mountains, and the Appenines.

The Alps extend in a semicircle from the Gulf of Genoa to the Tyrol, in Austria, and to parts of the range are given special names. Taking them in order from the Gulf of Genoa we have the *Maritime Alps*, extending to Mount Viso; the *Cottian Alps* to Mont Cenis, through which the railway of the overland route to India runs; the *Graian Alps* to Mont Blanc, the highest mountain in Europe, over 15,000 ft. high; the *Pennine Alps* to Monte Rosa; the *Lepontine Alps* to Mount St. Gothard, where rise the Rhine and the Rhone; and the *Rhaetian* and *Carnic Alps*, forming the boundary between Italy and Austria.

Many of the peaks are covered with perpetual snow, from the partial melting of which numerous rivulets are supplied with water, which they carry to the Po, which drains the plain on the southern slopes of the Alps.

2. What do you know of Dresden, Hamburg, Malta, Stockholm, Dardanelles, Ionian Isles, and Cadiz.

Dresden.—The capital of Saxony, and noted for the manufacture of China ware.

Hamburg.—An important port at the mouth of the Elbe, carrying on an important trade with England and America.

Malta.—The name of a small group of islands to the south of Sicily, belonging to the British. The soil has been spread over the bare rocks, so that now good crops of oranges, olives, &c., are produced. It forms an important coaling station for our fleet in the Mediterranean. *Chief town*, Valetta.

Stockholm.—The capital of Sweden, situated at the junction of Lake Maelar and the Baltic. It has an important trade and exports dried fish, tar, timber, and tallow.

The Dardanelles are a long narrow strait connecting the Ægean Sea with the Sea of Marmora; on its northern shore stands the important port of Gallipoli. Its importance is due to its being the entrance to the Black Sea trade.

Ionian Isles.—A string of islands lying to the south-west of the Turco-Grecian Peninsula. They formerly belonged to Britain, but were ceded to Greece on the accession of the present king. They produce currants and other fruits.

Cadiz is an ancient town, and the most important port of Spain; it is situated on the Isle de Leon, and exports large quantities of fruits and Sherry wine.

3. What is meant by '*latitude*?' And what by 'longitude.'

Latitude is the distance of a place north or south of the equator measured in degrees along a great circle.

Longitude is the number of degrees between the meridian of a place and a fixed meridian.

4. When it is noon at Greenwich, it is half-past two in the afternoon at Moscow. Can you explain this?

The sun rises in the east, and therefore places to the east get the sun first. Thus the sun crosses the meridian of Moscow 2½ hours before it crosses that of Greenwich. Now there is a difference in time of one hour for every 15° of longitude.

Moscow is $\therefore 2\frac{1}{2} \times 15 = 37\frac{1}{2}°$ east longitude.

Candidates taking the subjects of Standard VI.

1. Write what you know about Melbourne, Ottawa, Delhi, Auckland, the Suez Canal, and the Ghauts.

Melbourne is the chief town and seat of government of Victoria, in Australia. It is situated on Port Philip, and has a very extensive trade. Its importance has been due to its proximity to the gold diggings.

Ottawa, on the river Ottawa, is the seat of government of the dominion of Canada. It is engaged in the lumber and corn trade.

Delhi, on the Jumna, a tributary of the Ganges, is the chief city of the Punjab, it has many ruins of ancient Mogul edifices, and an important inland trade.

Auckland, the largest town of New Zealand, situated in the North Island on the isthmus that leads to the north-west peninsula of the North Island.

Suez Canal, the cutting of which was completed in 1869, joins the Red Sea to the Mediterranean. About 2,000 ships pass through it annually. It greatly shortens the way to India, and facilitates our commerce with Arabia and Persia.

The Ghauts, eastern and western, form respectively the east and west side of the Deccan, in the south of India. These hills are the condensers which form the rain clouds during the monsoons.

2. Name the provinces which make up the Dominion of Canada, the chief town of each province, and the principal exports of the Dominion.

Province.	Capital.
Ontario	Ottawa.
Quebec	Quebec.
New Brunswick	Fredericton.
Nova Scotia	Halifax.
Manitoba	Winnipeg (Fort Garry).
British Columbia	Victoria and New Westminster.
Prince Edward's Island ...	Charlotte Town.

The principal exports of the Dominion are:—Timber, petroleum, corn, preserved fruits and fish, furs, and meat.

3. Mention a few of the circumstances upon which the climate of a country depends, and illustrate your answer by reference to some of the British possessions.

(*a*) *Latitude*; the nearer the Equator the greater the heat, other things being equal. *E.g.*, the South of India is hotter than Malta.

(*b*) *An insular position or otherwise.*—The sea cools in summer and warms in winter. Thus take London and Quebec. These are in the same latitude, but England has an insular while Quebec has an inland climate; hence Quebec is subject to great extremes of heat and cold.

(*c*) *Cold or warm currents* round the shores. Coast of Newfoundland and England. Both insular, and in same latitude, yet Newfoundland is chilled by a cold current flowing round its shore, while England is warmed by the Gulf Stream.

(*d*) *The nature of the surface, mountainous or otherwise, elevated or low-lying.*—The mountains cool the air and moderate the heat of the neighbourhood. Thus the N. of India is cooled by the Himalayas, while in the low-lying west coast of Africa, which is in the same latitude S. as the Himalayas are N. of the equator, the heat is unbearable.

Candidates taking the Subjects of Standard VII.

1. Write what you know about the causes of ocean currents. Trace the course of the Gulf Stream.

Warm water is lighter, bulk for bulk, than cold water. Therefore warm water tends to come to the surface while cold water sinks to the bottom. The heat of the sun in the Tropics heats the water, which becomes lighter, bulk for bulk, than that in higher latitudes; the water here presses under the warmer equatorial waters and thus a deep sea current sets in from the cold regions to the warm, or from the Polar to the Equatorial regions. But the place of the water that flows from the poles must be supplied; this is done by the warm water at the surface flowing as a surface current towards the poles.

The direction of the currents is partly due to the obstruction of land, and partly to the fact that at the equator the speed of motion of the surface of the earth, due to the rotation of the earth, is much greater than in higher regions.

The Gulf Stream passes out from the Gulf of Mexico, through the Straits of Florida, and then runs parallel to the coast of the United States, being separated from which, however, by a cold northern current. On reaching Newfoundland the Gulf Stream turns to the east, and in a broadened stream crosses the Atlantic to the British shores; then turning south round the Bay of Biscay it is deflected to the S.W. and crosses the Atlantic as a North Equatorial Current. It thus has a circular course and encloses the Sargasso or Grassy Sea.

2. Explain the meaning of the word 'Planet.' Write out a list of the Planets in the order of their distances from the Sun; and explain the term 'transit of Venus.'

Planet is derived from the Greek word *planetes*, a wanderer, from *Planaomai*, I wander.

The bodies so called receive their name from the fact of their changing their positions with regard to the fixed stars.

Mercury, Venus, Earth, Mars, Asteroids (or Minor Planets) Jupiter, Saturn, Uranus, and Neptune.

'Transit of Venus' is another name for the Eclipse of the Sun by Venus. The disc of Venus is seen to pass across the face of the Sun without affecting to any sensible degree the Sun's luminosity.

3. Tell what is meant by the 'phases of the Moon' and explain the cause of them. What are the relative positions of the Sun, Moon, and Earth, at New Moon, and Full Moon?

The 'phases of the Moon' are the different forms or appearances of the Moon's illuminated surface. They are caused by the Moon revolving round the Earth and thus altering her position with regard to the Sun and Earth. When the Moon is between the Earth and the Sun, the illuminated half is turned away from us, and consequently we cannot see her disc at all. This is 'New Moon.'

When the Moon is on the side of the Earth remote from the Sun we look on the whole of the illuminated portion. This phase is called 'Full Moon.'

History.

BOYS AND GIRLS.

Candidates of all Classes.

1. Write out a brief account of the reign of one of our English sovereigns.

Henry V. In 1413 Henry IV.'s son, who had given such little promise, was proclaimed king, and at once showed his sense of the responsibility and dignity of the kingly office by severing his connection with his former dissolute companions.

His first act, however, was marked by cruelty. He rigidly suppressed the Lollards, who were attempting to bring about a reformation of the Church, and caused Sir John Oldcastle, the leader of the movement, to be burned as a heretic.

Anxious to win glory in war, Henry renewed the claim to the French crown, and demanded the fulfilment of the treaty of Brittany. Receiving an insulting answer he declared war. Before setting out, the king discovered a plot against his life, and Lord Scroop, and Richard, Earl of Cambridge, were beheaded for complicity in the plot.

Landing in October, 1415, with 30,000 men at the mouth of the Seine, Henry marched towards Calais. He was intercepted by the Constable of France at *Agincourt*, where he gained a complete victory, although the French were ten to one. The French general and the elite of the French army were slain. In 1417 Henry again landed in France and besieged Rouen, which surrendered after six months.

The Treaty of Troyes was then drawn up, the chief provisions being (1) That Henry should marry Catherine, daughter of the French king (2) That Henry should succeed to the French throne on the death of the imbecile Charles.

While on a short visit to England, the English army, under the Duke of Clarence, met with a serious reverse which recalled Henry to France; he returned and was completely victorious. He had returned to England amid a great welcome when he was attacked by a disease, from which he died in 1422.

2. Write a short life of some great English Statesman.

William Pitt—the grandson of a Governor of Madras, was educated at Oxford. In 1735 Old Sarum returned him as its representative to Parliament. At this time he was in the army, whence he was dismissed by Walpole on account of his opposition to that statesman in the House.

He was throughout his life untainted by bribery, which he never hesitated to expose and condemn.

In 1756 he became Secretary of State and Leader of the House. George II. dismissed him for his defence of Admiral Byng, but the popular indignation compelled his reinstalment in office. Under his able direction Canada was taken from the French, who were also defeated at Minden and Brest.

On the accession of George III., Pitt, in consequence of the Family Compact between Spain and France, recommended war with Spain, but failing to gain his object, retired from office with a pension of £3000 a year. The passing of the Stamps Act caused the American colonists to feel very bitterly towards England. This, Act, however, was repealed, but affairs becoming critical, Pitt, now Earl of Chatham, again took office, but failed to prevent the taxation of the colonists in America. In 1775 the American war broke out, and in 1778 Chatham, in a passionate speech in condemnation of the war, fell down in the House of Lords in a fit, from which he died.

3. Explain the terms Constitutional Monarchy, Magna Charta, Borough, and Parliament.

A Constitutional Monarchy is a state or government in which power of the King or Supreme Magistrate is limited by the laws of the country, or by fundamental principles.

Magna Charta is the name applied to the 'Grand Charta' of English liberties granted in the first instance by King John to the Barons in 1215.

Borough (from A.-S. beorgan, to keep, guard, preserve) formerly meant a fortified town or hill, but now is applied to such towns, villages, or districts that send representatives or burgesses to parliament.

Parliament (French Parlement—Parler, to speak, and the Latin termination mentum). It is the grand assembly of the three estates, the *lords spiritual*, the *lords temporal*, and *the commons*, constituting the legislature, and summoned by the sovereign's authority to *consult* on the affairs of the nation, and to enact and repeal laws.

END OF FIRST YEAR.

Arithmetic.

BOYS ONLY.

1. What is meant by the greatest common factor (or measure) of two numbers? Reduce $\frac{3241}{5093}$ to its lowest terms by finding the greatest common measure?

The G.C.M. of two or more numbers is the greatest number that is contained exactly in each of those numbers.

3241	5093
1832	3241
1389	1852
1389	1389
	463

G.C.M. = 463.

$$\frac{3241 \div 463}{5093 \div 463} = \frac{7}{11} \text{ Ans.}$$

2. Divide 13·26 by ·039, and multiply the result by ·0001.

$$\frac{13{\cdot}26}{{\cdot}039} = \frac{13260}{39} = 340$$

$$340 \times {\cdot}0001 = \underline{{\cdot}034}. \quad \text{Ans.}$$

3. Simplify $\frac{14{\cdot}08}{44{\cdot}8} \times \frac{437{\cdot}5}{13{\cdot}75}$

$$\begin{array}{rr} & 5 \\ & 35 \\ 2 & 175 \\ 128 & 4375 \\ 1408 & 43750 \\ 4480 & 13375 \\ 448 & 55 \\ 64 & 11 \\ 1 & 1 \end{array} \times = \underline{10} \quad \text{Ans.}$$

4. Add together $3\frac{1}{2}$ of 10s. $0\frac{3}{4}$d.; $2\frac{1}{8}$ + 14s. $10\frac{3}{4}$d.; $2\frac{1}{4}$ of 17s. $7\frac{3}{4}$d.; $1\frac{5}{8} \times$ 14s. $0\frac{3}{4}$d.

$3\frac{1}{2} \times$ 10s. $0\frac{3}{4}$d. = £1 10s. $2\frac{1}{4}$d. + 3s. $4\frac{1}{2}$d. $\times 2$ £ s. d.
= £1 10s. $2\frac{1}{4}$d. + 6s. $8\frac{1}{4}$d. = 1 16 $10\frac{1}{2}$
$2\frac{1}{8} \times$ 14s. $10\frac{3}{4}$d. = £1 9s. $9\frac{3}{4}$d. + 2s. $11\frac{1}{2}$d. $\times 3$
= £1 9s. $9\frac{3}{4}$d. + 8s. $11\frac{1}{2}$d. = 1 18 $8\frac{3}{4}$
$2\frac{1}{4} \times$ 17s. $7\frac{3}{4}$d. = £1 15s. $3\frac{1}{4}$d. + 2s. $6\frac{1}{2}$d. = 1 17 $9\frac{3}{4}$
$1\frac{5}{8} \times$ 14s. $0\frac{3}{4}$d. = 14s. $0\frac{3}{4}$d. + 1s. $6\frac{1}{2}$d. $\times 8$
= 14s. $0\frac{3}{4}$d. $\times$ 12s. 6d. = 1 6 $6\frac{1}{4}$
£7 0 0 Ans.

GIRLS ONLY.

1. Make out in proper form, and receipt a bill for the following:—

$13\frac{3}{4}$ yds. of velvet @ 7s. 6d. per yd., $7\frac{1}{2}$ yds., of crape @ 2s. 9d. per yd., $3\frac{1}{4}$ yds. of cloth @ 10s. 8d. per yd., $26\frac{1}{2}$ yds. of linen @ 1s. 10d. per yd., and 18 yds. of flannel @ 1s. 4d. per yd.

March 25th, 1887.

Mrs. J. Brown,

Dr. to W. J. Robins and Co.

Date		£	s.	d.
Jan. 27	$13\frac{3}{4}$ yds. of velvet @ 7s. 6d. per yd.	5	3	$1\frac{1}{2}$
Feb. 8	$7\frac{1}{2}$ yds. of crape @ 2s. 9d. per yd.	1	0	$7\frac{1}{2}$
Feb. 16	$3\frac{1}{4}$ yds. of cloth @ 10s. 8d. per yd.	1	17	4
Feb. 16	$26\frac{1}{2}$ yds. of linen @ 1s. 10d. per yd.	2	8	7
Mar. 7	18 yds. of flannel @ 1s. 4d. per yd.	1	4	0
		11	13	8

Received. W. Stamp. J. Robins and Co. per S. M. T. 27/5/87

2. The sum of 2 numbers equals $\frac{1}{4} + \frac{2}{3} + \frac{7}{12}$, and one of them equals $\frac{1}{2} + \frac{1}{3} + \frac{1}{5}$; find the other.

$$\tfrac{1}{4} + \tfrac{2}{3} + \tfrac{7}{12} = \frac{6 + 9 + 14}{24} = \tfrac{29}{24}$$

$$\tfrac{1}{2} + \tfrac{1}{3} + \tfrac{1}{5} = \frac{15 + 10 + 6}{30} = \tfrac{31}{30}$$

$$\tfrac{29}{24} - \tfrac{31}{30} = \frac{145 - 124}{120} = \tfrac{21}{120} = \underline{\tfrac{7}{40}}. \quad \text{Ans.}$$

3. Distinguish between measure, common measure, and greatest common measure. Find the least common multiple of 5, 7, 14, 21, and the greatest common measure of 455 and 595.

A *measure* of a number is any number that is exactly contained in that number.

A *common measure* of two or more numbers is a number that is contained exactly in each of those numbers.

The *greatest common measure* of two or more numbers is the greatest number contained exactly in each of those numbers.

$$\begin{array}{r} 7) \; 5, \; 7, \; 14, \; 21 \\ \hline 5, \; 2, \; 3 \end{array}$$

L. C. M. $= 7 \times 5 \times 2 \times 3 = \underline{210}$.

$$\begin{array}{r|l} 455 & 595 \\ 420 & 455 \\ \hline 35 & 140 \\ & 140 \\ \hline & \cdots \end{array}$$

G. C. M. = 35.

4. What is the difference in value of two fields, one of which contains 5 acres 3 roods 27 perches, valued at 50 guineas an acre, and the other contains 4 acres 3 roods 5 perches valued at £65 an acre?

			£	s.	d.
2 r.	$\frac{1}{2}$	1 a.	52	10	0
					5
			262	10	0
1 r.	$\frac{1}{4}$	2 r.	26	5	0
			13	2	6
20 p.	$\frac{1}{8}$	1 r.	6	11	3
5 p.	$\frac{1}{4}$	20 p.	1	12	$9\frac{3}{4}$
2 p.	$\frac{1}{10}$	20 p.	0	13	$1\frac{1}{2}$
			310	14	$8\frac{1}{4}$

			£	s.	d.
2 r.	$\frac{1}{2}$	1 a.	65	0	0
					4
			260	0	0
1 r.	$\frac{1}{4}$	2 r.	32	10	0
5 p.	$\frac{1}{8}$	1 r.	16	5	0
			2	0	$7\frac{1}{4}$
			310	15	$7\frac{1}{4}$

£310 15s. $7\frac{1}{4}$d. − £310 14s. $8\frac{1}{4}$d. = $\underline{11\frac{1}{2}}$d. Ans.

Grammar.

BOYS AND GIRLS.

1. 'A *widow* bird *sat mourning* for *her love*,
Upon a wintry *bough*;
The *frozen* wind *crept* on *above*
The *freezing* stream *below*.'

Analyze the first two lines.

Subject. A widow bird. *Predicate.* Sat.

Extensions of Predicate.—(*a*) upon a wintry bough (place). (*b*) mourning for her love (accompanying circumstance).

2. Parse the words in italics in the above passage.

widow—noun used adjectively, qualifying 'bird.'

sat—intransitive, strong verb, active, indicative, past, singular, 3rd person, agreeing with 'bird.'

mourning—present participle of the intransitive weak verb to mourn, active voice, attributive to 'bird.'

for—preposition showing the relation between 'mourning' and 'love.'

her—personal pronoun, singular, feminine, 3rd person, possessive case, attributive to love.

love—abstract noun (used for the concrete 'lover'), singular, neuter, objective case by 'for.'

bough—common noun, singular, neuter, objective case by upon.

frozen—participial adjective, qualifying wind.

crept—intransitive, strong-weak verb, active, indicative, past, singular, 3rd person, agreeing with wind.

above—adverb of place, qualifying 'crept.'

freezing—participial adjective, qualifying stream.

below—adverb of place, qualifying 'crept.'

3. In each of the following words, peaceful, brightness, darken, joyous, streamlet, murderer, give the force of the affix. Give also two examples of words similarly formed.

AFFIX	FORCE	EXAMPLES
ful	full of	hopeful, joyful
ness	abstract formative	darkness, vividness
en	to make	blacken, sharpen
ous	partaking of possessing	beauteous, momentous
let	little	brooklet, bracelet
er	agent	labourer, usurer

4. Explain how prepositions may be distinguished from adverbs. Give examples of the same word used in one sentence as a preposition, and in another as an adverb.

(*a*) If the word be a *preposition*, by asking the question formed by the preposition and the word 'what,' the sentence supplies an answer in the form of a noun or pronoun.

E.g., In what? In the room. *E.g.*, I saw him in the room. This is not so with the *adverb*. *E.g.*, come *in*.

(*b*) An adverb that modifies a verb can generally be moved to other parts of the sentence without affecting the relative positions of the other words in the sentence, whereas a preposition can be moved only in connection with the word it governs.

E.g. They went *over* together. *Over* they went together. *Adverb.* They went over the sea together. *Over the sea* they went together. Prep.

Geography.

BOYS AND GIRLS.

1. Give an account of the physical features, industries, and places of interest to travellers in *one* of the following counties:—Devon, Warwick, Carnarvon, Durham.

Devon. Physical features.—The surface of Devon consists of a plateau in the centre and south-west, known by the name of Dartmoor Forest, the highest peak of which is Yes Tor. This splendid moor affords pasture to a fine breed of sheep, and forms the main watershed of the county. From it flow to the north, the Taw and the Torridge, to the south the Dart and the Teign. The whole of the surface of Devonshire is undulating, and most of the hill-tops are covered with woods and copses, thus making the rivers exceedingly beautiful. In the north-east of Devon, on the borders of Somerset, is Exmoor Forest, where the Exe, the largest stream of Devon, rises.

Industries. (*a*).—Agriculture and sheep and cattle rearing. This forms the staple industry of the county. The Devon cattle, a small but choice breed, is highly prized. Much attention is given to dairy work; hence large quantities of butter, clotted cream and eggs are sent to London. At Honiton lace is manufactured. *Plymouth* and *Devonport* has a Government dockyard, which gives employment to large numbers; its excellent harbour too has naturally brought it a large trade with foreign ports.

Places of Interest.—Dartmoor convict prison is a sombre place right up on the moor. *Bideford*, an old town on the Torridge, was the starting place of many an expedition by the Elizabethan navigators, and has still a small trade with Wales. Barnstaple, at the mouth of the Taw, is beautifully situated, and a fashionable pleasure resort, as also is Ilfracombe on the most northern point of Devon. On the south coast are many favourite watering place, among which are Teignmouth, Torquay, Exmouth, Sidmouth, Dawlish, and Dartmouth. Two railways, the London and South-Western, and the Great Western, run through the county, the former north of Dartmoor, the latter along the coast. *Exeter*, the chief town, is a thriving place with a handsome cathedral. Crediton, Okehampton and Tavistock are important little inland towns on the South-Western railway.

2. Describe the basins of the Rivers Murray and St. Lawrence.

(*a*) *Murray.*—This river rises in the Australian Alps, and flows north-west, forming a natural boundary between NewSouth Wales and Victoria; after flowing about 60 miles into South Australia, it bends at right angles and flows due south into Encounter Bay, forming at its mouth the Alexandrina and Albert Lakes. It receives on its left bank a number of unimportant streams from the extension of the Australian Alps that lie along the centre of Victoria. On the right bank it receives the *Lachlan* (which receives on its left bank the *Murrambidgee*) and the *Darling*. The greater part of the courses of these rivers is through desert or at present uninhabited regions.

(*b*) The *St. Lawrence* drains the great string of freshwater lakes—Superior, Huron, Michigan, Erie and Ontario—which lie between the Dominion of Canada and the United States. Passing out from Lake Ontario its waters are divided into a number of small passages by what are known as the Thousand Islands. A hundred miles further on is the important city of Montreal, on an island connected by a famous tubular bridge with the mainland. Here too is the confluence of the River Ottawa, on which stands Ottawa, the seat of government of the Dominion. Passing the confluence of the Richelieu, which drains Lake Champlain, we arrive at Three Rivers, where the rivers St. Francis and St. Maurice join the main stream. Quebec, on the left bank, is the next important city, opposite the confluence of the Chaudière. The river now expands into a broad estuary of the sea, 300 miles long, and receiving on the left bank the Saguenay river, the St. Lawrence empties itself into the Gulf of St. Lawrence.

3. How would the occupations of a settler in Manitoba differ from those of a settler in New South Wales in December?

In December the seasons at Manitoba and New South Wales will be respectively winter and summer. Thus, in Manitoba the inhabitants will be able to do no agricultural work by reason of the soil being covered with snow and frozen hard; they will be engaged in sledging and hunting for fur-bearing animals. In New South Wales the farmers will be employed in cutting and carrying their hay and making preparations for the approaching corn harvest.

FIRST YEAR.

History.

1. What do you know of the following persons:—Boadicea, Dunstan, Godwin; and the following places: Athelney, Stonehenge, and Stamford Bridge?

Boadicea, Queen of the Iceeni, received an insult from the Roman officers. She revolted, and massacred the Roman garrison of Camalodunum (Colchester). Being defeated by Sactonius, she poisoned herself. (A.D. 61).

Dunstan became Archbishop of Canterbury in A.D. 960. Having great influence over King Edgar, he was enabled to bend the clergy to his will. On the accession of Edward the Martyr (975), he found his power to force submission gone, and had to submit to discuss his great object—the enforced celibacy of the clergy—in councils.

At the Council of Calne, the floor gave way under his opponents, and precipitated them below. This was looked upon as miraculous.

Dunstan died in A.D. 988.

Godwin, Earl of Wessex, was a powerful noble in the time of Edward the Confessor. For revolt against the King he was exiled, but returned in 1052.

Harold, his son, afterwards became King.

Athelney is the district between the rivers Parret and Tone in Somersetshire. In the time of Alfred, it was inaccessible except by boat on account of bogs and watercourses. There Alfred was in hiding from the Danes in A.D. 878.

Stonehenge is the name given to two huge circles of stones in the south of Salisbury Plain, in Wiltshire. They are generally said to be the remains of a Druidical temple.

At *Stamford Bridge*, on the Derwent, Harold, King of England met and defeated Tostig, his outlawed brother, and Harold Hardrada, King of Norway (1066). Tostig had demanded to be re-instated as Earl of Northumbria, which position he had lost through the revolt of his subjects. He, and his ally were slain.

2. Name three of the principal Roman roads and three Roman towns in Britain.

The three chief Roman roads were (1) Watling Street, from the Kentish Coast to London, and thence into Wales, and by another branch past Eboracum (York) to Caledonia. (2) Ermine Street, running from St. David's to Southampton, and (3) Fossway, between Cornwall and Lincoln.

Towns:—Londinum, Eboracum, Deva.

3. Explain terms Earl, Hundred, Burgh, Witenagemot, and Danegeld.

Earl is derived from the Saxon 'caldorman' or 'alderman,' a man who had the administration of a shire. Later, the title became merely personal.

A *Hundred* is supposed to be a division of land, embracing 100 families, or warriors, or manors; of course a hundred varied in size according to the density of the population. A *Burgh* was originally the fortified house of a man. Afterwards the term was applied to the fortified 'tûn' (town). The *Witenagemót* was the great national council. It was not a common assembly of the people, as the folk-moot of each shire, but consisted of the Witan (wise men). The ceorls had not the smallest share in the deliberations, and no traces of election exist. *Danegeld* was a tax levied, at the king's discretion, to repel the Danish invasions, and continued after that time. The name disappears after 1163, but the 'carucage' levied by Richard I. was virtually the same thing.

4. Describe, as accurately as you can, the battle of Hastings.

Finding a surprise impossible, Harold took up a strong position on Senlac Hill, seven or eight miles from Hastings. William immediately took up a position on an opposite height. Negotiations having failed, the armies came into conflict on 14th of October, 1066. The Saxons, numbering about 20,000, stood in a solid mass, armed with the battle-axe. The Kentish men were in the van, the men of London guarding their king. The Normans were in three divisions—archers, mailed pikemen, and knights in armour, the last led by William himself. Battle opened with the advance of the Normans. Falling upon the granite-like wedge of Englishmen, they staggered down the ridge, gashed by Kentish bills. This was repeated again and again, until the Norman archers began to shoot into the air, their arrows falling upon the unprotected heads of the foe. By one of these Harold was mortally wounded. At length a pretented flight of the Normans drew the English from their lines. The Normans rallied, and, with a sudden onslaught, captured the Saxon banner, and routed their brave foe.

END OF SECOND YEAR.

Arithmetic.

GIRLS ONLY.

1 How would you illustrate a first lesson in fractions? Express as a simple fraction in its lowest terms.

$$\frac{8\frac{1}{2} - 3\frac{1}{4}}{2\frac{1}{2} + 1\frac{1}{8}}$$

(*a*) Take an orange and divide it into say 12 equal pieces. Each of these 12 pieces is called a *fraction*. Each of these pieces is, on account of there being 12 equal pieces, called one-twelfth; then put 3, 4, and 6 of the pieces together consecutively, and show that $\frac{3}{12}$ is a *quarter*, and $\frac{4}{12}$ *one-third*, and $\frac{6}{12}$ *one-half*.

A cube consisting of smaller cubes affords an excellent means of illustrating this lesson.

$$\frac{8\frac{1}{2} - 3\frac{1}{4}}{2\frac{1}{2} + 1\frac{1}{8}} = \frac{4\frac{1}{2} - 1\frac{1}{4}}{\frac{5}{2} + \frac{9}{8}} = \frac{\frac{164 - 65}{20}}{\frac{8 + 15}{20}} = \frac{99}{23} = 4\frac{7}{23} \text{ Ans.}$$

2. Reduce 15 cwt. to the fraction of 17 tons 12 cwt. 56 lbs.

15 cwts. = 60 quarters

17 tons 12 cwt. 56 lbs. = 1410 quarters

$$\frac{60}{1410} = \frac{2}{47} \text{ Ans.}$$

3. A boy after spending $\frac{2}{3}$ of his money in oranges finds that $\frac{1}{2}$ of what he has left amounts to 2s. If the oranges cost $1\frac{1}{2}$d. each, how many did he buy?

$1 - \frac{2}{3} = \frac{1}{3}$; $\frac{1}{2} \times \frac{3}{1} = \frac{1}{3}$; $\frac{1}{3} = 2$s. $\therefore \frac{3}{3} = 10$s. = original sum.

The boy spent $\frac{2}{3}$ of his 10s. in oranges, *i.e.*, he spent 4s.

$$\frac{4\text{s.}}{1\frac{1}{2}\text{d.}} = \frac{96}{3} = 32. \qquad \underline{32 \text{ oranges.}} \text{ Ans.}$$

4. A person finds that a hat which cost him 15s. lasted 7 months, and that another for which he paid 11s. lasted only 5 months; which of the two qualities will it be more advantageous to him to buy in future? Show how your answer is obtained.

$\frac{15\text{s.}}{7}$ = 2s. $1\frac{1}{7}$d. = cost of wearing a hat for a month according to first purchase.

$\frac{11\text{s.}}{5}$ = 2s. $2\frac{1}{5}$d. = cost per month according to second purchase.

Therefore the 15s. hat was the most advantageous.

Grammar.

BOYS AND GIRLS.

1. 'The maypole is *up*,
Now give me the cup,
I'll drink to the garlands *around* it;
But first unto *those*,
Whose hands did *compose*
The glory of flowers *that* crowned it.

Give in your own words the meaning of the above passage.

Now that we have finished erecting the maypole, hand me the tankard that I may drink to the honour of the wreaths that entwine it. I must first of all, however, remember the fair ones whose deft fingers have so cleverly arranged the flowers that form the crown of the pole.

2. Analyze the above passage and parse the words in italics.

No. of Sent.	Kind of Sent.	Connective	Subject	Predicate	Object	Extension of Predicate
A	Principal		The maypole	is up		now (time)
B	Principal cop. co-ord. with A.		You	give	the cup (direct) me (indirect)	
C	Principal cop. co-ord. with A and B		I	will drink	to the garlands around it (indirect)	
D	Principal advers. co-ord. with C.	But	(I)	(will drink)	unto those (indirect)	first (order)
E	Subord. adj. sent qual. those		whose hands	did compose	the glory of flowers	
F	Subord. adj. sent qual. flowers		That	crowned	it	

Up—adverb of place modifying 'is.'

now—adverb of time, modifying 'give.'

give—trans., strong verb, act., imperative, pres., plural, 2nd, ag. with you.

me—pers. pron., sing., mas., 1st, obj. case by 'to' (or dat. case by give).

I'll = *I*—pers. pron., sing., mas., 1st, nom. to will drink.

will—aux. verb, sign of future tense.

around—prepos. showing relation between 'garlands' and 'it.'

those—demonstrative pron., plur., fem., 3rd, obj. case by 'unto.'

whose—rel. pron., plur., fem., 3rd, poss. case, attributive to hands.

compose—trans., weak verb, act., infin., governed by did.

that—rel. pron., plural, neuter, 3rd, nom. to crowned.

3. Point out the Latin prefixes (giving the force of each) in the lines—

'Vain transitory splendors! could not all
Reprieve the tottering mansion from its fall?
Obscure it sinks, nor shall it more impart
An hour's importance to the poor man's heart.'

Point out also the Latin terminations.

Prefix.	Force.
trans	across.
re	back.
ob	in the way of.
im	on or upon.

Affix.	Force, &c.
ory	adj. formative.
or	noun ,,
ion	,, ,,
ance	,, ,,

4. Give three examples of adjective sentences, and three of adverbial sentences.

(*a*) *Adjective.*—He is the man *who stole your book.*
That is the house *where I was born.*
That occurred in the year *when the Queen was crowned.*

(*b*) *Adverbial.*—I saw him *where I left you yesterday.*
I will come *if you will have my company.*
He was so tall *that he could see over my head.*

Geography.

(BOYS AND GIRLS.)

1. Describe fully the basin of the Rhine.

The Rhine rises in Mont St. Gothard in the Lepontine Alps, in the south of Switzerland; with the exception of a small portion of Switzerland to the south of the Bernese Alps, the Rhine and its tributary the Aar, with their smaller tributaries, drain the whole of Switzerland. The melting of the snow on the mountains of Switzerland causes the Rhine to be a considerable river by the time it joins Lake Constance in the north-east corner of this country. Passing out from Lake Constance we reach the Schaffhausen Falls, and then the Rhine forms the boundary between Baden and Switzerland, receiving on its left bank the Aar, on which stands Berne, and which brings with it the waters of Lakes Zurich, Lucerne, Bienne and Neufchatel. At Basle the river flows north through a valley at the foot of the Schwarzwald; passing Stratzburg, Spires and Mannheim, where the Neckar, on which stands Heidelberg, joins the Rhine, we come to Mayence, at the junction of the Maine, on which stands Frankfort. The Rhine now flows through the splendid plain known as the Rhine Province. At Coblenz the lovely Moselle, on which stands Treves, joins the main stream, flowing past Bonn, Cologne, and Dusseldorf, at Nemiguen it turns westward and flows through Holland by two large branches, the Old Rhine and the Waal, the latter of which is joined just before reaching the sea by the Maas, which drains Belgium and Holland. On the Old Rhine in Holland are the important ports of Rotterdam and Schiedam.

2. State what you know of Delhi, Benares, Cawnpore, Surat, the Punjaub, Simla, and Point de Galle.

Delhi, on the Jumna, the chief town of the Punjaub, was built on the ruins of a grand old Mogul city. It has an important inland trade.

Benares, on the Ganges, is the holy city of the Hindoos, who swarm hither as pilgrims. This circumstance, however, gives rise to considerable trade.

Cawnpore, a great military and commercial town on the Ganges, memorable for the massacre of women and children during the mutiny of 1857.

Surat, at the mouth of the Taptee, is on the Baroda railway; here the first English factory in the Mogul dominions was established.

Punjaub, 'the land of five rivers,' is a fertile plain in the north-west of India, drained by the Indus and its tributaries, the Chenab, Jhelum, Ravee, and Sutlej: it contains the important towns of Delhi, Lahor, Amritzur, Moultan, and Peshawar.

Simla, is a sanatorium in the Punjaub on a spur of the Himalayas, near the River Sutlej.

Point de Galle, an important town on the south coast of Ceylon, is a port of considerable trade, and a coaling station for ships bound for Australia, *via* the Suez Canal.

3. At what part of the world is the sun visible at midnight on June 21st. Explain the reason of this phenomenon.

The sun is visible at midnight on June 21st at all places between the Arctic Circle and the North Pole.

On June 21st the sun is vertically over the tropic of Cancer 23½° north of the Equator. Consequently the circle of illumination will be tangential to the Arctic and Antarctic circles on that day. The whole of the Arctic regions will be included in the illuminated half of the world, while the whole of the Antarctic will be excluded. Thus, as the earth turns round on its axis each point of the earth in the frigid zone is kept in the illuminated portion, and therefore the sun can be seen there.

Arithmetic.

BOYS ONLY.

1. If a grocer lose 5 per cent. by selling sugar @ 4¾d. per lb., what percentage will he gain by selling it @ 5¼d. per lb.?

$$95 : 100 :: \overset{\text{d.}}{4\tfrac{3}{4}} : \text{cost price}$$

$$\frac{\overset{\text{farthings } 20}{19} \times \overset{}{100}}{\underset{5}{95}} = 20 = 5 \qquad 5\tfrac{1}{4} - 5 = \tfrac{1}{4} = \text{gain per 1 lb.}$$

$$\text{As } \overset{\text{d.}}{5} : \overset{\text{d.}}{\tfrac{1}{4}} :: 100 : 5$$

$$\frac{100 \times 1}{20} = 5$$

5 per cent. Ans.

2. A tea salesman mixes £90 lbs. of tea @ 1s. 6d. per lb., 50 lbs. @ 1s. 9d. per lb., and 20 lbs. @ 2s. 2½d. per lb. At what price must he sell it per lb. so as to neither gain nor lose?

	£	s.	d.
90 lbs. @ 1s. 6d. cost	6	15	0
50 lbs. @ 1s. 9d. ,,	4	7	6
20 lbs. @ 2s. 2½d. ,,	2	4	2
∴ 160 lbs. of tea cost	13	6	8

$$\therefore \text{ 1 lb. cost } \frac{£13\ 6\ 8}{160} = \frac{\overset{\text{pence}}{3200}}{160} = 20 = \underline{1\ 8} \text{ Ans.}$$

3. If I sell out £742 10s. three per cent. stock @ 99 and invest the proceeds in a four per cent. stock @ 135, what income shall I derive from it?

$$\frac{£742\ 10s.}{100} \times 99 = \overset{£\ s.\ d.}{7\ 8\ 6} \times 99 = \overset{£\ s.\ d.}{742\ 10} - \overset{£\ s.\ d.}{7\ 8\ 6} = \overset{£\ s.\ d.}{735\ 1\ 6}$$

= sum I invest in the 4 per cent. stock @ 135

$$\frac{£735\ 1s.\ 6d.}{135} \times 4 = \frac{£2940\ 6s.}{135} = \underline{£21\ 15s.\ 7\tfrac{1}{7}d.} \text{ Ans.}$$

4. Explain the terms 'ratio' and 'proportion;' and show that the four quantities 9 yds. 1 ft. 5 in., 2 yds. 1 ft. 9 in., 7 lbs. 15 oz. 14 drams, 2 lbs. 2 oz. 14 drams, are proportionals.

Ratio is the relation which one quantity bears to another of the same kind, the comparison being made by considering what multiple part or parts one quantity is of another.

When two ratios are equal the four quantities composing them are said to be proportional. Thus, taking the examples in the question

$\frac{9 \text{ yds. } 1 \text{ ft. } 5 \text{ in.}}{2 \text{ yds. } 1 \text{ ft. } 9 \text{ in.}}$ and $\frac{7 \text{ lbs. } 15 \text{ oz. } 14 \text{ drs.}}{2 \text{ lbs. } 2 \text{ oz. } 14 \text{ drs.}}$ are two ratios; if these fractions or ratios, when reduced to their lowest terms, are equal, they will then be *proportionals*, or *in* proportion.

$$\frac{9 \text{ yds. } 1 \text{ ft. } 5 \text{ in.}}{2 \text{ yds. } 1 \text{ ft. } 9 \text{ in.}} = \frac{341}{93} \qquad \frac{7 \text{ lbs. } 15 \text{ oz. } 14 \text{ drs.}}{2 \text{ lbs. } 2 \text{ oz. } 14 \text{ drs.}} = \frac{2046}{558} = \frac{341}{93}$$

These quantities are therefore proportionals.

Euclid.

BOYS ONLY.

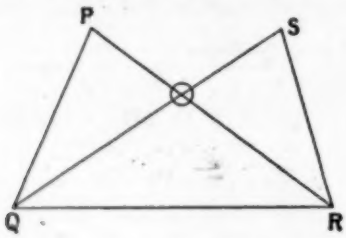
1. If two triangles have two sides of the one equal to two sides of the other, each to each, and have also the angles contained by those sides equal, they shall likewise have their bases or third sides equal, and their other angles shall be equal, each to each, viz., those to which the equal sides are opposite.

Answer.—Book I. Proposition 4.

2. If one side of a triangle be produced, the exterior angle is greater than either of the interior opposite angles.

Answer.—Book I. Proposition 16.

3. PQR and SQR are two triangles on the same base, QR, and on the same side of it, having PQ equal to SR, and PR equal to SQ. If PR and SQ meet in O, prove that QO equals OR, and that OP equals OS.



Answer.—By I. 8 and I. 4 the triangles PQR, SQR, are equal in every respect.

Therefore the angle QPR = the angle RSQ.

In the triangles QOP, SOR, the angle QOP = the angle SOR (I. 15), and the angle QPO = the angle RSO, and QP = RS.

Therefore QO = OR, and OP = OS (I. 26) [Q. E. D.]

SECOND YEAR.

History.

BOYS AND GIRLS.

What steps did Henry II. take to check the evils which had grown up during Stephen's reign? What were the chief causes of his quarrel with Becket?

1. Henry II. immediately upon his accession endeavoured to undo the evils consequent upon the reign of Stephen. He issued new coins, drove from England the foreign hirelings, who had swarmed into England during the civil war, and set himself to destroy the castles of the barons.

The chief causes of Henry's quarrel with Becket were:—

(*a*) *The punishment of clergy charged with crime.*—Becket maintained that clerics were answerable for their conduct to ecclesiastical courts only. The utmost punishment those courts could inflict consisted in degrading the offender from his office, and reducing him to the condition of the laity. Henry had proposed (1163) that priests guilty of felony should be tried by temporal courts.

(*b*) Becket demanded from the barons—his former associates—the restitution of estates belonging to his see, which he accused them of retaining unjustly.

2. Name two celebrated statesmen, two celebrated navigators, and two celebrated writers, during the reign of Elizabeth. Say briefly what was done by each.

Statesmen in the reign of Elizabeth:

(*a*) *William Cecil*, afterwards *Lord Burleigh*, a cool and sagacious minister, during 40 years of the reign. He rose to be Lord Treasurer; suppressed the Babington conspiracy; and wisely directed the Queen in all important policy; and greatly increased the revenues of the kingdom. He died in 1598.

(*b*) *Sir Francis Walsingham*, Secretary of State, healed the hatred between Elizabeth and James I. after the execution of Mary Queen of Scots. He did much to direct the relations of Elizabeth with the European States, and to form a strong Protestant union.

Navigators:

(*a*) *Sir Francis Drake* made several expeditions to the West Indies. In 1577—80 he sailed round the world. In 1587 he sailed into Cadiz harbour, and destroyed much shipping. He served as vice-admiral under Howard against the Spanish armada in 1588. He died in 1596.

(*b*) *Lord Howard of Effingham*, though a Roman Catholic, was lord high admiral of the English fleet against the Spanish armada (1588). He, with the Earl of Essex, destroyed a Spanish fleet in Cadiz harbour in 1596. For this he was made Earl of Nottingham. He died in 1624.

Writers:

(*a*) *Edmund Spenser* was the second great English poet. His chief work was the 'Faerie Queen,' written in a stanza of nine lines. He died in 1599.

(*b*) *William Shakespeare* wrote 37 plays between 1591 and 1614. He wrote also sonnets and other poems. Died 1616.

3. What were the circumstances in which Edward I. invaded Scotland? Describe, as accurately as you can, either of the following battles:—Bannockburn, or Flodden Field.

In 1292 there were two claimants for the throne of Scotland. Edward I. claimed a right to interfere on the ground that William the Lion had acknowledged himself vassal of Henry II. (1175), and that Richard I. had no right to dispose of the suzerainty. On this pretext Edward appointed John Baliol king. Then he goaded his vassal into resistance, and, marching northward, subjugated Scotland.

The battle of *Bannockburn* was fought in 1314. The English, under Edward II., numbered 100,000, the Scottish, 40,000. Bruce had previously caused pits to be dug in the ground, and had covered them with hurdles. By a rapid charge Bruce shook the English ranks. At this moment the Scottish camp-followers, to the number of 20,000, rushed from a hill close by. Thinking this a fresh army, the English broke into headlong rout. Edward rode to Dunbar, and thence escaped to England.

4. Why may the accession of Henry VII. be regarded as the beginning of modern English history? What discoveries made the latter half of the 15th century remarkable?

The improvements in navigation were soon to lay open a new world as well as a new route to Asia. Hence was to arise a new system of relations among the States of Europe. The commerce of Europe began to be diverted to the Western Powers. England took a leading part among these nations.

In our language, too, a new period commenced. By the 'Revival of Learning,' many new words of classical origin were introduced, and the language became more expressive.

The spelling and pronunciation became more fixed.

Maritime research received a new impetus by the discovery of America in 1492—98. Meanwhile Vasco de Gama had doubled the Cape of Good Hope, and opened up a new route to India. Sebastian Cabot, sent by Henry VII. from Bristol, discovered Newfoundland, and coasted down the seaboard of North America (1497).

Teaching.

BOYS AND GIRLS.

(*Answer two questions only.*)

(*For teachers in schools for older scholars.*)

1. 'Old David lived in a hut beside the river. Every year at a certain time a great flood came, and all the rabbits were driven out of their holes by the rising of the river. Then David used to turn out with his boat and save the poor things by taking them into it and rowing them up to the higher banks out of the reach of the water.'

In teaching a second standard to read the above passage (1) what words or letters in it are the children in your school liable to mispronounce, and how do you set about correcting them? (2) What words will require special attention in respect of spelling?

(1) (*a*) *Words*—Old (pron. ole), hut (pron. 'ut), every (pron. evry), certain (certin), flood (with the vowel sound of stood), things (fings), taking (takin), rowing (o as in barley-*mow*), higher (ier), water (vater in low districts).

Form strings of words with the same vowel sound, or ending in *d*'s, *l*'s, and *ing*, or beginning with 'h' or 'th' according to the error you are dealing with, and make the children collectively and individually go over them again and again.

(*b*) *Letters*—Final *d*'s, *i* in time, pronounced like *oi*, final *g*'s, *r* in *r*each pron. like *w*, *th* like f.

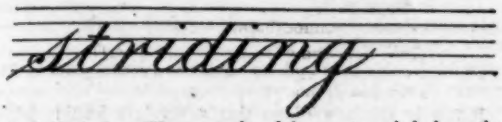
To cure these show the children how to place the tongue with reference to the other parts of the mouth in order to produce the sounds, and exercise them in lists of words with the same difficulties.

(2) Beside (biside), river (rivver), year (yer), certain (sertin), great (grate), rabbits (one b and two t's), driven (two v's), rising (z for s), boat (bote), rowing (roing), higher (hier), reach (reetch), water (warter).

2. In teaching first standard children to add mentally 23 and 18, into what groups would you lead them to break up either or both numbers?

Split 23 into 20 + 3; and 18 into 10 + 8
or leave 23 undivided, and split 18 into 10 + 8.

3. Write the word striding in small letters and point out the mistakes in it which you would watch for.



Probable faults.—The up-stroke of the *s* not carried above the height of the r and i, &c.
The dot of the 's' stuck at the end of the stroke like a potato on a stick instead of being formed by a coil from left to right.
The joints of the letters (which should be at half the height of the letters r, i, n, &c.) either below or above that height,
The t and d made too high and not of the same height.
The o of the d and g and the long stroke not in contact.
The o of the d and g begun at the top or on the left side.
The slope in different directions.
The down strokes uneven in thickness and *painted*.
The letters not kept strictly to the line.
The dots of the i's either omitted or too small.

For teachers in infants' schools.

4. Describe the plan followed in your school in beginning to teach the youngest children to read.

(1) The children are taught to know the alphabet by heart and to call the letters by name when they see them.

(2) Little syllables containing the short vowels are learnt, such as *an*, *en*, *in*, *on*, *un*. Then some of the simplest consonants are taken and placed successively before each of these syllables, as han, ben, &c., dan, den, &c., kan, ken, &c.

(3) Little sentences as soon as possible are taken when irregularities are met with, such as do, to; these must be learnt by the look-and-say method.

5. What use can you make of the ball frame in teaching the number 4 to the lowest class of the school?

Let a child come to the frame and move one ball to the other side, then let another child move another to join the other ball, another child may now be required to move the 2 together, and they may learn the name of the number of those two balls, viz., *two*.

Add another and let this group be moved as one thing, whose name is *three*. Now let the fourth be added to the other 3, and this group be named *four*. Let the children divide the four balls into groups of different sizes and thus learn all that can be learnt about the numbers.

6. Describe any way of teaching the children to hold their pencil properly. What are the common mistakes to be guarded against?

(*a*) Insist on long pencils. This can be done by using pencil-cases. Let the holding of the pencils be one of the *exercises* of the class; let the children simultaneously take up their pencils, hold them so that the teacher can see if they are held properly, and correct any that are wrong; and then let them move the pencil as though writing. This latter will give freedom.

(*b*) The common mistakes are—(*a*) Letting the handle of the pen lie down by the side of the thumb instead of being kept by the forefinger by the tip of the thumb. (*b*) Holding the pencil too tightly. (*c*) Holding it too near the point. (*d*) Raising the forefinger like a church-steeple.

END OF THIRD YEAR.

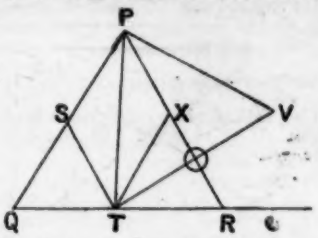
Euclid.

BOYS ONLY.

1. Parallelograms on the same base and between the same parallels are equal to one another. Bk. I. Prop. 35.

2. If the square described upon one of the sides of a triangle be equal to the squares described upon the other two sides of it, the angle contained by these two sides is a right angle. Bk. I. Prop. 48.

3. PQR is an equilateral triangle, PT is drawn perpendicular to QR. Prove that the equilateral △ described upon PQ is equal to the equilateral △s described on PT and TQ.



Bisect PQ, PR at S and X. (I. 10.)
Join ST, XT.
On PT describe an equilateral triangle PVT, VT cutting PR in O.
Then in the triangles PQT, PRT,
The angle QPT = the angle RPT and QT = RT. (I. 4.)
Therefore QT = QS, being halves of the equals PQ, RQ.
Therefore the angle QST = the angle QTS. (I. 5.)
Now the three angles of the triangle SQT = two right angles. (I. 32.)
And the angle SQT is a third of two right angles.
Therefore QST and QTS are each a third of two right angles.
Therefore the triangle SQT is equiangular and equilateral.
In the same way it may be proved that XTR is equilateral.
Now the angle QPR = the angle TPV, being each a third of two right angles. Take away the common angle TPR.
Then QPT = RPV.
But QPT is half of QPR.
Therefore RPV is half of TPV. Therefore RPV = TPR.
Therefore the triangle TPO = the triangle VPO. (I. 4.)
And the angles POT, POV, being adjacent and equal, are right angles.
Therefore TOR is also a right angle. (I. 15.)
Therefore the triangle TOX = the triangle TOR. (I. 26.)
And the triangle PST = the triangle PXT. (I. 4.)
Therefore POV = POT = PST and TOR.
Now the triangle PQR is made up of the triangles QST, PST, POT, and TOR.
Therefore PQR = QST, POT, and PVT; that is, QST and PTV.
But PQR is the equilateral triangle on PR, and PVT is the equilateral triangle on PT, and QST is the equilateral triangle on QT.
Therefore the equilateral triangle, &c. Q.E.D.

Algebra.

BOYS ONLY.

1. Divide $x^3-(a+b+c)x^2+(bc+ca+ab)x-abc$ by $x-a$

$$
\begin{array}{l|l}
x-a & x^3-x^2(a+b+c)+x(bc+ca+ab)-abc \;(\; x^2-bx-cx+bc \\
\underline{x^3-x^2a} & \\
 & -x^2b-x^2c+xbc+xca+xab-abc \\
 & \underline{-x^2b+xab} \\
 & -x^2c+xbc+xca-abc \\
 & \underline{-x^2c+xca} \\
 & xbc-abc \\
 & \underline{xbc-abc}
\end{array}
$$

$x^2-bx-cx+bc = \underline{x^2-x(b+c)+bc}$. Ans.

2. Find the value of $\frac{1}{x-1}-\frac{2}{x}+\frac{1}{x+1}$

L. C. D. $= (x-1)(x+1)x = x(x^2-1)$

$$\frac{x(x+1)-2(x^2-1)+x(x-1)}{x(x^2-1)} = \frac{x^2+x-2x^2+2+x^2-x}{x(x^2-1)}$$

$$= \frac{2}{\underline{x(x^2-1)}} \text{ Ans.}$$

3. Solve the equation $\frac{1}{2}(x-2)+\frac{1}{3}(x-3)+\frac{1}{4}(x-4)=10$

$$\frac{x-2}{2}+\frac{x-3}{3}+\frac{x-4}{4}=10$$

$$\frac{6x-12+4x-12+3x-12}{12}=10$$

$$13x = 120+36 = 156$$

$$x = \tfrac{156}{13} = \underline{12}. \text{ Ans.}$$

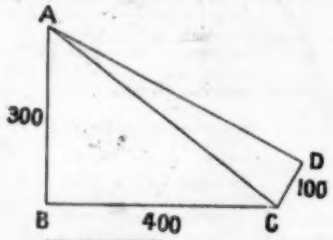
4. A certain number by having 40 added to it becomes three times as great. Express this statement in the form of an equation.

Let x be the required number, then $x + 40 = 3x$. Ans.

Mensuration.

BOYS ONLY.

1. ABCD is a field of which two opposite angles at B and D are right angles. If AB = 300 yds., BC = 400 yds., CD = 100 yds., find the area.



$AC = \sqrt{(300^2 + 400^2)}$

$= \sqrt{250{,}000} = 500$ yards.

$AD = \sqrt{(500^2 - 100^2)} = \sqrt{240{,}000}$

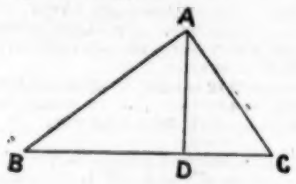
$= 200\sqrt{6}$ or 489·89 yards.

Triangle ABC $= \frac{1}{2}(300 \times 400) = 60{,}000$

Triangle ADC $= \frac{1}{2}(489{\cdot}89 \times 100) = 24{,}494$

$\therefore$ Area of field $= 84{,}494$ sq. yds.

2. The sides of a right-angled plot of ground measure 1·5 and 2 chains respectively; find the perpendicular distance in yards from the right angle to the opposite side.



AD = twice the area of ABC $\div$ BC

twice ABC $= 2 \times 1{\cdot}5$;

$BC = \sqrt{(2^2 + 1{\cdot}5^2)} = 2{\cdot}5$

$$AD = \frac{2 \times 1{\cdot}5}{2{\cdot}5} = \frac{6}{5} = 1{\cdot}2 \text{ chains.}$$

1 chain = 22 yds. $\therefore$ 1·2 chains $= 1{\cdot}2 \times 22 =$ 26·4 yds. Ans.

Arithmetic.

GIRLS ONLY.

1. Multiply ·6$\dot{3}$ by ·5$\frac{1}{3}$, and show how you would explain to your class what vulgar fractions can be converted into terminating decimals and what cannot.

(*a*) ·6$\dot{3}$ = $\frac{6}{9}$ ·5$\frac{1}{3}$ = $\frac{16}{30}$

$$\frac{\cancel{7}\ \cancel{63}}{\cancel{99}\ 33} \times \frac{\cancel{16}\ \cancel{48}}{\cancel{30}\ \cancel{10}\ 5} = \frac{\cancel{8}}{\cancel{165}}$$

(*b*) A terminating decimal fraction when reduced to a vulgar fraction always has for its denominator 10, 100, 1000, or some *power of* 10; that is to say, the denominator equals 10, or 10 multiplied by itself any number of times.

e.g., ·03 = $\frac{3}{100}$, ·003 = $\frac{3}{1000}$, ·0003 = $\frac{3}{10000}$

Now 100 = 10 × 10 1000 = 10 × 10 × 10

10000 = 10 × 10 × 10 × 10

Now let us divide these denominators into their lowest or ultimate factors; we then see that

10 = 5 × 2; 100 = 5 × 2 × 5 × 2

10000 = 5 × 2 × 5 × 2 × 5 × 2 × 5 × 2

We see thus far then those vulgar fractions whose denominators when divided into their lowest factors consist of 'fives' and 'twos' can be converted into terminating decimals.

But we may have a vulgar fraction which consists of all fives for its factors or all twos for its factors.

Let us examine an example of each.

(1st.) $\frac{3}{25}$. This can be made into a decimal by multiplying both numerator and denominator by 4.

Thus $\frac{3}{25} = \frac{12}{100} =$ ·12

It could be similarly shown with any fraction whose denominator was a *power* of 5.

(2nd.) $\frac{3}{4}$. Multiply both numerator and denominator by 25.

Then $\frac{3}{4} = \frac{75}{100} =$ ·75

It can be similarly shown that any vulgar fraction whose denominator is a power of 2, would become a terminating decimal. By examining the last two cases, it will be seen that the 25 was multiplied by 2 × 2; and the 4 was multiplied by 5 × 5. So that at no time had we any other factors than fives and twos.

Here then is the conclusion:

A vulgar fraction whose denominator when split up into its ultimate factors consists of all fives, or all twos, or only of fives and twos, will make a terminating decimal. In all other cases the decimals will not terminate.

2. How many cakes would be required for a school of 57 children, of whom 26 are boys and the rest girls, if each girl has $\frac{1}{3}$ of a cake, and each boy half as much again as each girl?

$\left\{\frac{1}{2} + (\frac{1}{2} \times \frac{1}{3})\right\} \times 26 = \frac{3}{6} \times 26 = 7\frac{1}{2}$ = Boys' supply.

57 − 26 = 31 girls $\frac{1}{3} \times 31 = 6\frac{1}{3}$ = Girls' supply

$7\frac{1}{2} + 6\frac{1}{3} =$ 14 cakes. Ans.

3. A piece of cloth containing $17\frac{3}{10}$ yds. cost £7 11s. 4½d.; find the value of 19 pieces of cloth of the same quality, each piece containing $19\frac{1}{2}$ yds.

$17\frac{3}{10} : 19\frac{1}{2} \times 19$ :: £7 11s. 4½d.

20
151
12
1816
2
3633 halfpence.

$$\frac{3633 \times 19\frac{1}{2} \times 19}{17\frac{3}{10}}$$

$$= \frac{\cancel{3633} \times 119 \times 19 \times \cancel{10}}{\cancel{6} \times \cancel{173}} = 79135 \text{ halfpence}$$

2 | 79135
12 | 39567 ½d.
20 | 3297 3
£164 17 3½. Ans.

4. A bankrupt owes three creditors A, B, and C, £265 10s., £372 15s., and £438 12s. 6d. respectively; on a division of his estate being made, A received £179 4s. 3d.; how much in the £ is the dividend, and what does each of the other creditors receive?

As £265 10s. : £179 4s. 3d. :: £1 :

20 20
5310 3584
4 4
21240 14337

$$\frac{1 \times \cancel{14337}}{\cancel{21240}} = 13\text{s. } 6\text{d.}$$ He $\therefore$ pays 13s. 6d. in the £.

7080

As £1 : £372 15s. :: 13s. 6d. : B's share

13s. 6d. × 372½ = £251 12s. 1½d.

As £1 : £438 12s. 6d. :: 13s. 6d. : C's share

13s. 6d. × 438¼ = £296 1s. 5½d.

Grammar.

BOYS AND GIRLS.

1. Romeo.—*Lady*, by yonder blessed moon I swear,
That tips with silver all the fruit-tree tops.
Juliet.—Oh, *swear* not by the moon, the inconstant *moon*,
That *monthly* changes in her *circled* orb,
Lest they *that* love *prove* likewise *variable*.

Give the meaning of the passage in your own words.

Romeo. My love, I swear by the beautiful moon which you now see fringeing with its silvery light those fruit trees.

Juliet. Oh, let your vows be witnessed by something more constant than the fickle moon which during the course of her monthly revolution round this earth passes through so many different phases, for fear that her changeableness should be typical of the character of your vows.

2. Analyze the above and parse the words in italics.

No. of Sentence	Kind	Connective	Subject	Predicate	Object	Extension of Predicate
A	Principal	Lady (person addressed)	I	swear		by yonder blessed moon (imprecation)
B	Subordinate adjective qualifying moon		that	tips	all the fruit-tree tops	with silver (instrument)
C	Principal	Oh (ejaculation)	you	swear		not (negation) by the moon (imprecation) the inconstant moon
D	Subordinate adjective qualifying moon		that	changes		monthly (time) in her circled orb (place)
E	Subordinate of purpose	lest	they likewise	prove variable		
F	Subordinate adjective qualifying they		that	love		

Lady—Com. noun (used here as a proper noun), sing., fem., 2nd, nom. of address.
that—rel. pron., sing. neuter, 3rd, nom. case to tips.
swear—intrans., strong verb, act., imper., pres., sing., 2nd, ag. with thou.
moon—com. noun, sing., neut., obj. case, in apposition with moon,
monthly—adverb of time (repetition), mod. changes.
circled—participial adj. qual. orb.
that—rel. pron., sing., plur. 3rd, nom. to love.
prove—Intrans., weak verb, subj., pres., plur., ag. with that.
variable—adj. of qual., qual. persons (understood).

3. 'Our language abounds with works of imagination not inferior to the noblest that Greece has bequeathed to us, with models of every species of eloquence, with historical compositions which have never yet been surpassed, and with just and lively representations of human life and nature.'

Point out in the above passage the words which you recognise by their form as having been derived from the Latin language, and give in each case another example of a word similarly constructed.

Latin Word in Passage.	Other Example.	Latin Word in Passage.	Other Example.
Language	Passage.	Historical	Comical.
Imagination	Ratiocination.	Compositions	Superstitions.
Abounds	Abstract.	Surpassed	Compassed.
Noblest	Gentlest.	Just	...
Inferior	Superior	Representations	Dispensations.
Models	Novels.		
Species	Superficies.	Human	Mundane.
Eloquence	Effervescence.	Nature	Picture.

4. Explain and give examples of a *noun in apposition*, *a noun sentence*, and a *reflexive pronoun*.

A noun is said to be in *apposition* with another noun when it is placed by the side of it (which is the meaning of *apposition*—Lat. ad, at, and pono, positus, I place) to add something to the information already given, or to give another name to the thing signified by the noun with which it is in apposition.

E.g., *This* is *Thomas*, my *brother*.
That *man* is *Brown*, the *butcher*.

Here Thomas and brother are in apposition with *this*, all referring to the same person.

So also are Brown and butcher in apposition with man.

A *noun sentence* is a sentence that can occupy that position or hold that relation to a verb that a noun can.

E.g., He said *he would come.*—*Object.*
That he did this is plain.—Subject.
It is a shame *that he did this.*—In apposition.

A reflexive pronoun is used when the action reflects upon, or is performed upon, the doer of the action.

Thus, He hurt *himself.*—*Direct object.*
I gave *myself* a treat.—*Indirect object.*

The reflexive pronoun can never be used in the nominative case.

Geography.

BOYS AND GIRLS.

1. State what you know of St. Helena, Mauritius, Cyprus, Borneo, Canton, Timbuctoo, and Zanzibar.

St. Helena.—A small island to the west of the Gulf of Guinea, rises abruptly from the sea, and reaches in Diana's Peak a height of 2,000 ft. It has numerous fresh water springs. Napoleon was banished here after his defeat at Waterloo.

Mauritius lies in the Indian Ocean to the east of Madagascar. It was ceded to us by the French in 1814, and produces sugar, spice, and valuable woods. Chief town is Port Louis.

Cyprus.—Fertile island, lying to the east of the Mediterranean, and having an area of 3,700 square miles. The climate is unhealthy through defective draining. The chief town is Nicosia. It is rich in minerals, but has no good harbours. Since 1878 its affairs have been administered by the British Government.

Borneo, one of the largest islands in the world, is situated in the centre of the East Indian Islands. Its interior is almost unknown. Its highest known peak reaches 13,670 ft. It produces teak, gutta percha, palms, canes. The largest portion is under Dutch rule. Diamonds have been found here.

Canton, a town on the south-east coast of China, near Hongkong, was the first, and for a long time the only, port allowed to trade with Europeans. In 1842 additional ports were opened.

Timbuctoo, at the great bend of the Niger, in the Soudan, is the great emporium of inland trade across the desert.

Zanzibar, an island about 56 miles long, situated to the east of Africa to the north of Mozambique, is separated from the mainland by a channel 30ft. wide. It produces coco-palms, mangos, rice, sugar, and millet. It has a busy commerce in ivory, pepper, hides, and cotton goods. Till recent years it was a great slave mart.

2. Explain the terms — Trade winds, monsoons, cyclone, typhoon, tidal wave. Of what use are the trade winds in a voyage from England to Australia?

Trade winds are winds perpetually blowing in the same direction, namely from the north-east north of the equator, and from the south-east south of the equator. Ships getting into the regions of these winds in the Atlantic found their voyages much expedited, and so called them trade winds. These winds are caused by the heated air of the tropics being replaced by the cold air from the poles, and the direction is due to the greater speed of rotation at the tropics than in higher latitudes.

Monsoons (derived from the Arabic mawsim, a season) is a term applied to the periodical winds of the Indian Ocean. In the northern summer, the land of Asia becoming hotter than the water of the ocean, the cooler air off the ocean sets in as a wind to displace the heated air on the continent. This causes the south-west monsoon, which blows from April to October. In the other half of the year, when Africa is very hot, the monsoon blows in the opposite direction.

Cyclone (Greek, kuklos, a circle) is a wind whose course consists of a series of curves whose general course is a curve. They prevail in the Indian Ocean at the time of the changing of the monsoons.

Typhoons (Chinese, *ta*, great; *fang*, wind) is the name given to cyclones in the Chinese seas, where they prevail from June to September.

Tidal Wave.—As the earth turns round, each portion is brought under the attraction of the moon. The waters of the earth are drawn to that portion of the Ocean nearest the moon. As the earth rotates, the position of this accumulation of water changes, and thus there is a continual series of rising while beneath the moon and subsiding as the moon's attraction diminishes in force. The progress of this higher water is called a tidal wave. It is generally three hours after the moon in consequence of the inertia of the water.

To a ship going to Australia from England the trade winds would be of no assistance at all, but a hindrance in the Indian Ocean. On the return journey they would be of benefit.

3. From which of our possessions in Asia and Africa do we chiefly derive the following imports:—Rice, cane-sugar, coffee, teak-wood?

Rice.—India, Ceylon, Mauritius, Gambia Settlements, Sierra Leone, Burmah.

Cane-sugar.—Mauritius, Burmah,

Coffee.—Ceylon, India, West Africa.

Teak-wood.—Burmah and further India generally.

History.

BOYS AND GIRLS.

1. What were the abuses provided against in the following:—

(*a*) *Petition of Right* (1628).—This statute required the king to levy no taxes without consent of Parliament; to detain no one in prison without trial; and to billet no soldiers in private houses.

(*b*) *Habeas Corpus Act* (1679) was a writ addressed to the custodian of a prisoner requiring him to produce him for trial at a certain time. Former sovereigns had, without remorse, left their enemies to pine and waste for years in prisons. But, by the 'Habeas Corpus,' no man can be kept beyond a certain time in prison, without a fair trial; and no prisoner, once acquitted, can be recommitted for the same offence.

(*c*) *Reform Bill* (1832).—By this enactment (1) the right of sending members to Parliament was taken away from pocket or rotten boroughs. (Old Sarum, on Salisbury Plain, had not a single house.) (2) Several towns, as Birmingham, Leeds, Manchester, and Sheffield, which had grown into large cities during last century, received the right of sending members to Parliament. (3) The franchise, or right of voting, was extended more widely among the middle classes.

2. Say what you know of any three of the following battles: Dunbar, Bothwell Brigg, Sedgemoor, the Boyne, the Nile, Plassy, Inkerman.

(*a*) *Dunbar.*—The Scots had proclaimed Prince Charles king, immediately on the death of Charles I. (1649). Oliver Cromwell marched northward, but found the district from the Tweed to the Forth laid waste. The Scots under David Leslie lay intrenched near Edinburgh. Oliver changed his position. Leslie followed him. At length when the Lord General was so hemmed in near Dunbar that nothing remained but surrender or a hopeless attack on the Scots, he saw them advancing to give battle on the plain. Oliver was victorious. (1650.)

(*b*) *Battle of the Boyne* (1690).—The English were commanded by William III. and Marshal Schomberg; the Irish by James II. The army of William forded the stream in three points, the divisions afterwards mustering coolly in the face of the Irish cannonade. Dashing on the Irish intrenchments, they swept them clean. Schomberg was killed. James II. fled to Kinsale, and escaped to France.

(*c*) *Inkerman* (Nov. 5th, 1854).—Concealed by a fog, 60,000 Russians pressed towards the English lines. The centre of the engagement was an earthwork—the two-gun battery, which the Russians had captured. Nine hundred of the Grenadier Guards recaptured it, and held it through the whole day. Eight thousand British troops, helped by six thousand French, kept the heights against a Russian force four times as great.

3. Describe the events which led immediately to the Revolution of 1688. What provisions were then made for the succession to the throne?

(*a*) James II. in 1686 began to unfold his design for the establishment of the Roman Catholic religion in England. By officering his army by Roman Catholics, in disregard of the Test Act, he purposed to overawe the nation. Then he commenced to tamper with the universities. At Oxford he appointed Anthony Farmer, a Catholic, president of Magdalene College. The Fellows refusing, they were shut out from the Church. Cambridge also suffered. The Fellows refusing to admit Alban Francis, a monk, to the degree of M.A., the vice chancellor lost his office (1687). The Declaration of Indulgence called forth a petition from the Primate and six bishops. Charged with libel, they were tried and acquitted. James brought over several regiments of Irish soldiers to crush the nation. Then William of Orange was invited to invade England, with promise of the crown.

(*b*) By the Declaration of Right (1689), confirmed by the Bill of Rights (1689), William and Mary were declared king and queen, the chief administration resting with him. The crown was settled first on the children of Mary, then on those of Anne; and, failing these, on the children of William by any other wife.

4. Give short accounts of any *two* of the following statesmen—Clarendon, Walpole, Canning, Peel.

(*a*) *Clarendon*, Edward Hyde, was born in 1608. In the Civil War he sided with the King, and was his chief adviser after the removal of Strafford and Laud. He joined Charles II. in Holland. Returning with him at the Restoration (1660) he was made Lord Chancellor. He was instrumental in passing a series of repressive Acts forming the Clarendon Code. They are:—(1) The Corporation Act (1661); (2) Act of Uniformity (1662); (3) Conventicle Act (1664); and (4) Five-mile Act (1664). In 1667 he escaped impeachment by flight. In his exile he wrote the 'History of the Great Rebellion.' He died at Rouen in 1674.

(*b*) *Peel*, Sir Robert, was born in 1788. In 1809 he entered the House of Commons as a Tory, and soon took a subordinate post in the Perceval Ministry. During his period of office as Chief Secretary for Ireland, he organized the constabulary force. He was twice Home Secretary and twice Prime Minister. In 1829 he opposed the Roman Catholic Emancipation, but, seeing that the peace of the country was in danger, he gave way and carried the Relief Act. He opposed parliamentary reform, and, at first, the repeal of the Corn Laws. On the latter subject his opinions changed, and he carried the Repeal Act (1846). His followers—Peelites—were ere long absorbed into the Liberal party; his opponents, the Protectionists, in a few years assumed the name of Conservatives. He died in 1850.

Teaching.

BOYS AND GIRLS.

1. Describe half a dozen exercises for Standard III., intended to show what an adjective is, and what its function is in a sentence.

(1) Give some simple sentences containing *adjectives of quality*. By asking *what kind of———?* and obtaining the answer from the children they will see what the function of such words is.

(2) Give them some common nouns, and let them make little sentences about them, adding suitable *adjectives of quality*.

(3) Give some simple sentences containing *adjectives of quantity*. By asking 'how many?' or 'how much?' and obtaining the answers from the children, the latter will see the function of such words.

(4) Let them form sentences themselves about nouns given by the teacher, and containing *adjectives of quantity*.

(5) Give sentences containing adjectives of distinction and demonstrative adjectives, and by asking *which?* the function of these words will be learnt.

(6) The children should now form their own sentences with this class of adjectives in them.

General exercises containing all kinds would follow, and a definition should be obtained from the children, describing all the functions of the adjective.

2. In the sentence, 'He came quickly,' which is the better answer of the two following, in reply to the question, 'What part of speech is quickly?' (1) '*Quickly* is an adverb because it ends in ly,' or (2) '*Quickly* tells you how he came, and therefore it is an adverb.' Give the reasons for your preference.

No. 2 is the best answer.

The first is an insufficient reason because all words that end in ly are not adverbs, *e.g.*—A *lively* boy; a *gentlemanly* man; a *lovely* girl. Here the words ending in ly are adjectives. But any word that tells *how an action is performed* is by definition an adverb, therefore the second answer, which states that *quickly* fulfils the requirements of the definition, is the correct one.

3. The length of a class room being 24 ft. and the width 18 ft., tell how you would teach a class (Standard I.) to make plans of such a room of three different sizes.

First on the blackboard show that it matters not what I take to represent a foot, so long as I take the required number of the same distances in the same plan. Illustrate this by two or three examples. Then let them, first of all, take $\frac{1}{8}$ in. to represent 1 ft., and mark out 24 of such distances one way; then at right angles to this from one end mark off 18 such distances, and then complete the oblong.

Next let them take successively $\frac{1}{4}$ and $\frac{1}{2}$ of an inch to represent a foot, and proceed as before.

For Teachers in Infant Schools.

1. How do you teach children to understand the meaning of the figures 1 and 5 in writing 15, and how the 1 comes to mean more than the 5?

In teaching numeration I should take the number 11 and show that the 1 in the units' place meant only 1, and that the 1 in the second place was ten.

Then analyze the number into 10 and 1; place them in a vertical column and add them.

10
1
11

Then take 22 and show that the 2 in the units' place is 2 ones, and that the 2 in the tens' place is 2 tens. Put these in a vertical column, and add as before.

20
2
22

Then take 57 and show that the 7 is 7 ones, and the 5 is 5 tens. Treat these as before.

The child will then be able to analyze the 15 and prove by addition the respective values of the figures.

2. Mention all the 'objects' which you would try to get ready if you were going to give a lesson on a 'lifeboat.'

A pail of water. A wooden boat. A lead weight sufficient, when fastened to the bottom of the boat, to right it when turned upside down. *Some pieces of cork and pieces of iron*, to show that cork may be able to keep the heavy iron above the surface. *Pieces of rope. Representation of a life-buoy.*

3. Taking a square of paper, what simple ideas of form can you impress on a class by folding the paper so as to make a single crease on it?

(1) oblong, (2) angle, (3) right angle, (4) triangle.

Arithmetic.

BOYS ONLY.

1. After paying an income tax of 8d. in the pound, a man had £510 5s. 7d. left. What was his income!

s. d. £ £ s. d.
As 19 4 : 1 :: 510 5 7 : Ans.

3 20
58 20
3
60

$$\frac{£510\ 5s.\ 7d. \times \overset{30}{60}}{\underset{29}{58}} = £17\ 11s.\ 11d. \times 30$$
$$= \underline{£527\ 17s.\ 6d.}\quad \text{Ans.}$$

2. Multiply 757·043 by 366·3 and divide the result by 2·7491.

757·043
366·3
2271129
4542258
4542258
2271129
277304·8509

Remove the decimal point of this dividend and of the divisor four places to the right. This does not affect the answer.

27491)2773048509(100871·139973082
27491
239485
219928
195570
192437
31339
27491
38480
27491
109890
82473
274170
247419
267510
247419
200910
192437
84730
82473
225700
219928
57720
54982
2738

100871·139973082 +. Ans.

3. A square court was covered with 136,161 tiles, each tile containing 16 square inches. What was the length of one of its sides?

Area of square court = 136161 × 16 square inches.

∴ side of square = $\sqrt{136161 \times 16} = 4\sqrt{136161} = 4 \times 369$
= 1476 in. = 41 yards.

136161(369
9
66)461
396
729)6561
6561

1476 in. = 41 yds. Ans.

4. Explain the reason why division by a fraction is equivalent to multiplication by the same fraction inverted; and divide £26 7s. 7½d. by 8½.

Take 270 ÷ ¾ for an example.

It is required to find how many three-fourths there are in 270. Let us first of all find out how many fourths there are. Since four fourths make a whole one, we shall have four times as many fourths as we have whole ones, *i.e.*, 270 × 4. But ¾ is 3 times ¼, ∴ we shall have only one-third as many three-fourths as we had of one-fourths, *i.e.*, $\frac{270 \times 4}{3}$

Thus we have multiplied by the denominator and divided by the numerator; that is, we have practically inverted the divisor $\frac{3}{4}$ and multiplied the 270 by it.

The reason is then 'that we multiply by the denominator to reduce the multiplicand to the denomination indicated by the denominator, and divide by the numerator to obtain the number of those parts indicated by the numerator.'

£ s. d. £ s. d. £ s. d.
26 7 $7\frac{1}{4}$ + $8\frac{1}{4}$ = 26 7 $7\frac{1}{4}$ ÷ $\frac{3}{4}$ = 26 7 $7\frac{1}{4}$ × $\frac{4}{3}$

	£	s.	d.	
	26	7	$7\frac{1}{4}$	
			3	
5	79	2	$9\frac{3}{4}$	
5	15	16	6	
	£3	3	$3\frac{1}{4}$	Ans.

(To be continued.)

—o—

Mental Arithmetic, its Principles and Practice.

BY REV. A. D. CAPEL, M.A.,

Author of 'Catch Questions in Arithmetic,' 'Tips in Algebra,' 'Easy Steps in Trigonometry,' etc., etc.

ANSWERS TO EXERCISES.

CHAPTER II.

1. 15,855.
2. 123,175.
3. 395,875.
4. 30,015.
5. 238,800.
6. 79,287½.
7. 57,468¾.
8. 210,625.
9. 184,815.
10. 4,700.
11. 4,732½.
12. 12,000.
13. 2,400.
14. 12,506¼.
15. 2,550.
16. 324,687½.
17. 2,568¾.
18. 2,287½.
19. 433,125.
20. 4,133¾.
21. 3,110.
22. 3,135.
23. 984⅜.
24. 1,791¼.
25. 4,106¼.
26. 879,907,500.
27. 1,151,050.
28. 11510·5.
29. 1022·34375.
30. 5951·5625.
31. 119·851425.
32. 6·05.
33. 201,250.
34. 5·20375.
35. 15·625.
36. ·05625,
37. 211·41.
38. 346·5.
39. 1,352.
40. 1995·25.
41. 19·375.
42. 6284·375.
43. 503·125.
44. 45,675
45. 18281·25.
46. 2,775.
47. 8,325.
48. 617,000.
49. 3,085,000.
50. 310156·25.

CHAPTER III.

1. 104.
2. 35·2.
3. 20·4.
4. 35.
5. 25.
6. 61.
7. 135·16.
8. 7·6.
9. 5·552.
10. 46·8.
11. 84·28.
12. 9·16.
13. 320·32.
14. 120.
15. 6·52.
16. 8·8.
17. 76·4.
18. 15·104.
19. 4·144.
20. 15·2.
21. 1·608.
22. 8·8.
23. 55·47.
24. 26·24.
25. 26·24.
26. 93·24.
27. 25·92.
28. 5·768.
29. 2·244.
30. 4,860.
31. 7·12.
32. 1·568.
33. 26⅓.
34. 1·894.
35. 2984·372.
36. 35·91.
37. 7,134.
38. 592·506.
39. 8·2928.
40. 66·7496.
41. 712·336.
42. 160.
43. 640.
44. 3·861.
45. 27·51.
46. 1·512.
47. 1·2232.
48. ·5248.
49. 1·26.
50. 4·303.

Note:—In *32*, read 58⅓ for 38⅓.

CHAPTER IV.

1. 69,597.
2. 702,297.
3. 71,003.
4. 703,703.
5. 73,629.
6. 7,036,029.
7. 12,222,144.
8. 653,666,679.
9. 86,506,420.
10. 9,850,631.
11. 80,830,904.
12. 6,177,233,583.
13. 85,041,495.
14. 99,980,001.
15. 12,589,953.
16. 7695·61668.
17. 10,395.
18. 240,759.
19. 2,513,084.
20. 229,152,231.
21. 441·2084.
22. 23,419,815.
23. 21,861,604,401.
24. 12,350,338,083.
25. 4,148,640.
26. 528,671,820.
27. 74808·30903.
28. 3,908,905.
29. 300,699.
30. 28,971.
31. 15,015.
32. 1,259,874.
33. 11,206,195.
34. 144,026.
35. 1,918,413.
36. 9,897,219.
37. 10,566,521.
38. 7,129,287.
39. 2,067,708.
40. 2,891,217.
41. 100,233.
42. 350,035.
43. 4,019,598.
44. 415,584.
45. 7012·1142.
46. 129·0486.
47. 2885·001.
48. 3,023,602,330.
49. 366·3.
50. 34675·29.

Note:—In *33* read 123,145 for 123,045.

CHAPTER V.

1. 221.
2. 1,581.
3. 1,457.
4. 2,077.
5. 3,055.
6. 875.
7. 3,375.
8. 3,626.
9. 1,073.
10. 1,349.
11. 805.
12. 2,209.
13. 3,080.
14. 2,296.
15. 2,613.
16. 969.
17. 2,304.
18. 1,369.
19. 3,956.
20. 6,786.
21. 2,430.
22. 1,207.
23. 4,606.
24. 3,071.
25. 8,075.
26. $\frac{1,855}{8}$.
27. $\frac{961}{11}$.
28. $\frac{768}{49}$.
29. $\frac{1,586}{6}$.
30. $\frac{7,565}{12}$.
31. 351.
32. $\frac{4,030}{9}$.
33. $\frac{3,721}{16}$.
34. $\frac{910}{3}$.
35. $\frac{4,015}{12}$.
36. $\frac{851}{8}$.
37. $\frac{3,111}{15}$.
38. $\frac{1,225}{4}$.
39. $\frac{5,621}{16}$.
40. $\frac{4,941}{12}$.
41. $\frac{425}{6}$.
42. $\frac{203}{4}$.
43. $\frac{385}{6}$.
44. $\frac{406}{3}$.
45. $\frac{297}{8}$.
46. $\frac{148}{7}$.
47. 50.
48. $\frac{957}{8}$.
49. $\frac{5,775}{16}$.
50. $\frac{700}{9}$.

CHAPTER VI.

TO MULTIPLY ANY NUMBER BY ANY NUMBER.

50. Let us have to multiply 3147, which we will call A, by 548, which we will call B. Again, working as in Algebra, and for shortness' sake writing 10^2, 10^3, &c., for 100, 1,000, &c., and using a dot (.) for the sign of multiplication:

$$\begin{array}{l} 3.10^3 + 1.10^2 + 4.10 + 7 \\ 5.10^2 + 4.10 + 8 \\ \hline 15.10^5 + 5.10^4 + 20.10^3 + 35.10^2 \\ \quad + 12.10^4 + 4.10^3 + 16.10^2 + 28.10 \\ \quad\quad + 24.10^3 + 8.10^2 + 32.10 + 56 \\ \hline 15.10^5 + 17.10^4 + 48.10^3 + 59.10^2 + 60.10 + 56 \end{array}$$

51. If we examine this we find there is only a single term in each, from which we obtain the units and hundreds of thousands, two terms in each from which we obtain the tens and tens of thousands, and three terms in each from which we obtain the others. Hence,

52. For units multiply the 2 unit figures, and put down the 6, carrying the 5. For tens carry the 5, multiply tens in A by units in B, and tens in B by units in A, thus, 5 (carried) + 32 + 28 or 65; write down the 5 and carry the 6. For hundreds carry the 6 and multiply hundreds in A by units in B, tens in A by tens in B, and units in A by hundreds in B, thus: 6 (carried) + 8 + 16 + 35 or 65 again writing down the 5 and carrying the 6. For thousands 6 (carried) + 3 (thousands in A) × 8 (units in B), + 1 (hundreds in A) × 4 (tens in B), + 4 (tens in A) × 5 (hundreds in B), or 6 + 24 + 4 + 20 or 54; write down the 4 and carry the 5. For the tens of thousands 5 (carried) + 3 (thousands in A) × 4 (tens in B) + 1 (hundreds in A) × 5 (hundreds in B), or 5 + 12 + 5 or 22; write down the 2 and carry the 2. For the hundreds of thousands, 2 (carried) + 3 (thousands in A) × 5 (hundreds in B), or 2 + 15 or 17;

hence 3,147 × 548 = 1,724,556.

53. Supposing we are obtaining any figure (say the thousands) of a product, and there are thousands in the multiplicand, the lines over the following expression (the multiplicand being placed to the left) will suggest the position of the three (or whatever number of figures there are in the multiplier) pairs, whose products have to be added: *e.g.*, what are the thousands in the product of 3147 × 472 (neglecting the figure to be carried from the hundreds). We may connect them thus:—3147 × 472: the lines showing us that the number will be 3 × 2 + 1 × 7 + 4 × 4, or 29.

54. The student might notice how the pairs approach each other. Again, to find the number of hundreds of thousands in the product 31467 × 472. Since there are no hundreds of thousands in the multiplicand we must begin with 3 × 7, and add to it 1 × 4, or 25 in all.

55. If the units of the sum of the 2nd products thus obtained be a large number, say 8 or 9, we shall have to get three of the smaller denominations to insure accuracy, if not 2 will almost always show us what figure has to be carried from the next denomination. *E.g.*, what is the figure in the tens of thousands in 3476 × 781. The hundreds (neglecting the tens) are 102, the thousands (adding the 10) are 94, and the tens of thousands (adding the 9) are 61, hence 1 will be found to be the figure required. Had the sum, which is here 94, been a nearer number to 100, the figure to be carried from the tens might have affected the 1 of the tens of thousands.

56. EXAMPLES 6.

1. 2,837 × 123.
2. 5,285 × 325.
3. 3,745 × 345.
4. 6,374 × 374.
5. 8,256 × 638.
6. 4,368 × 836.
7. 2,757 × 678.
8. 5,826 × 507.
9. 6,738 × 486.
10. 8,726 × 875.
11. 16,253 × 1234.
12. 7,896 × 2,357.
13. 63,843 × 4,567.
14. 68,437 × 3,486.
15. 4,235 × 4,268.
16. 3,471 × 3,471.
17. 27,813 × 3,742.
18. 37,123 × 4,716.
19. 5,493 × 5,493.
20. 37,216 × 1,245.
21. 117½ × 478.
22. 3,252 × 207½.
23. 4,264 × 384½.
24. 9,265 × 426½.
25. 4,212 × 329½.
26. 5,677 × 49½.
27. 4,267½ × 4,266.
28. 37 × 38 × 39.
29. 45 × 46 × 47.
30. 21,634 × 36,412.
31. (276 + 324) × (417 + 483).
32. (452 + 378) × 591.
33. (529 − 322) × 47.
34. 11⅓ × 1,111⅓.
35. 39⅓ × 42⅓.
36. 498⅓ × 244⅓.
37. 33⅓ × 33⅓.
38. 35,167 × 35,167.
39. $48^2 \times 35^2$.
40. 2 × 3 × 4 × 5 × 6 × 7 × 8 × 9 × 11 × 12.

Write down in the ten following products the figure whose denominator is placed in brackets:—

41. 347 × 459 (100).
42. 5,623 × 47,681 (10,000).
43. 37,216 × 2,471 (1,000).
44. 4,516 × 3,728 (100,000).
45. 35,467 × 28,187 (1,000,000).
46. 5,716 × 47,321 (10^6.)
47. 32,145 × 57,326 (10^4).
48. 29,168 × 37,165 (10^3).
49. 41,687 × 29,354 (10^7).
50. 41,654 × 37,216 (10^8).

CHAPTER VII.

TO FIND THE SQUARE OF A NUMBER.

57. Since $(a + b)^2 = a^2 + 2ab + b^2$ and $(a-b)^2 = a^2 - 2ab + b^2$; let us write any number (as 47) in the form of 40 + 7, then $(40 + 7)^2 = 1{,}600 + 560 + 49$; or 1,649 + 560; or 2,209.

58. It will be noticed as in Chapter V. that we can conceive the two squares at once (remembering that 01, 04, 09 are the square of 1, 2, and 3 respectively, if they appear in the units) and 560 is simply (4 × 7) × 2 with a cypher added.

59. If the number be near to a multiple of 10, as 69, it is better to conceive it in the form of (70−1) and then from 4,901 subtract 2 × 7 × 10, and so get 4,761.

60. Since $a^2 + 2ab^2 + b^2 = a(a + 2b) + b^2$ and $a^2 - 2ab + b^2 = a(a - 2b) + b^2$; some teachers use these formulæ thus:

$47^2 = (40 + 7)^2 = 40(40 + 14) + 49 = 2{,}160 + 49$, or 2,209, or thus:

$47^2 = (50 - 3)^2 = 50(50 - 6) + 9 = 2{,}200 + 9 = 2{,}209$.

61. I prefer the former method—as being more universal, and more in accordance with other multiplications. No doubt in the second of these latter methods the occurrence of the number 5 makes it accidentally easy.

62. To square a number ending in 5: $(75)^2 = (70 + 5)^2 = 70^2 + 70 \times 10 + 25 = 70\,(70 + 10) + 25 = 70 \times 80 + 25$. Hence—a very easy rule immediately suggests itself, multiply the tens by the number next to it, and affix 25, *e.g.*, $65^2 = 6 \times 7 \times 100 + 25$; or 4,225.

63. To square a number ending in 25: *e.g.* $(525)^2 = (500 + 25)^2 = 250{,}000 + 2 \times 500 \times 25 + 625 = 250{,}625 + 25{,}000$; or 275,625; whence we see that the last 3 figures are 625, the thousands will be 5 if the hundreds of the number to be squared be odd, and the tens of thousands are the square of the hundreds together with half the hundreds. To take another example:

$$825 = (64 + 4)\ 10{,}000 + 625;\ \text{or } 680{,}625.$$

64. To find the square of any number we may proceed thus—*e.g.* $(34{,}726)^2$ for units, square units $= 36$; for tens 3 (carried) $+ 2 \times 2$ (tens) $\times 6$ (units) $= 27$; for hundreds 2 (carried) $+ 2 \times 7 \times 6 + 2^2 = 90$; for thousands 9 (carried) $+ 2 \times 4 \times 6 + 2 \times 7 \times 2 = 85$; for tens of thousands 8 (carried) $+ 2 \times 6 \times 3 \times 2 \times 2 \times 4 \times 7^2 = 109$; for hundreds of thousands 10 (carried) $+ 2 \times 2 \times 3 + 2 \times 7 \times 4 = 78$; for millions 7 (carried) $+ 2 \times 7 \times 3 + 4^2 = 65$; for tens of millions 6 (carried) $+ 2 \times 4 \times 3 = 30$; for hundreds of millions 3 (carried) $+ 3^2 = 12$—hence $(34{,}726)^2 = 1{,}205{,}895{,}076$.

65. It will be noticed that when we multiplied the units by the tens of thousands and doubled them, that we next multiplied the two figures next to them, and, there still being a figure left, we squared that; this figure will show the operation, $\overbrace{34726}$. Then having multiplied the units by each of the other figures, we began with the tens but went to the last figure to the left at once thus $\overbrace{3472}$, and then with the hundreds, and so on.

66. Most of the high numbers as set in the examination papers to be squared are very nearly a multiple of 10, or 100, or 1,000, and could be expressed by subtraction, thus:
$(698)^2 = (700 - 2)^2 = 490{,}004 - 2{,}800 = 487{,}204$; but I believe a very little practice would enable a student to write down the square of any number as shown in the last paragraph.

67. There is another method of squaring numbers which is worthy of notice, and generally given in manuals of this kind. It depends on the following identity:—

$$a^2 = (a^2 - b^2) + b^2$$
$$= (a + b)(a - b) + b^2$$

e.g., $39^2 = 40 \times 38 + 1 = 1521$

or $47^2 = 50$ (*i.e.*, $47 + 3$) $\times 44$ (*i.e.*, $47 - 3$) $+ 9$
$= 50 \times 44 + 9 = 2{,}209$

$386^2 = 400 \times 372 + 14^2 = 148{,}996$.

68. Hence the following rule is manifest. Add that number which will make the number to be squared the next round number, and also subtract it, then write down the tens and units of the square of this number, and for hundreds, &c., multiply the difference obtained above by the hundreds, thousands, &c., of the sum, thus: $(589)^2$. We must add and subtract 11 and get 600 and 578, hence we square 121, and write down the 21, carrying the 1, and then multiply the 578 by 6, adding in the 1; hence $589^2 = 346{,}921$.

69. EXAMPLES VII.

Write down the squares of—

1. 17.
2. 23.
3. 25.
4. 29.
5. 35.
6. 37.
7. 41.
8. 53.
9. 65.
10. 66.
11. 73.
12. 75.
13. 79.
14. 81.
15. 83.
16. 87.
17. 698.
18. 891.
19. 793.
20. 1,500.
21. 1,109.
22. 1,509.
23. 807.
24. 709.
25. 1,901.
26. 109.
27. 625.
28. 115.
29. 108.
30. 129.
31. 251.
32. 511.
33. 691.
34. 1,293.
35. 1,191.
36. 1,498.
37. 7·91.
38. 82·5.
39. ·98.
40. ·0792.
41. $332\frac{1}{3}$.
42. $141\frac{1}{4}$.
43. $666\frac{2}{3}$.
44. $998\frac{3}{4}$.
45. $6{,}001\frac{1}{2}$.
46. $99\frac{1}{4}$.
47. $\frac{1}{2} \times \frac{3}{5} \times \frac{7}{7}$.
48. $2\frac{1}{2} \times 3\frac{3}{4} \times 1\frac{3}{5}$.
49. $(3\frac{1}{4} \times 5\frac{1}{2}) - \frac{1}{4}$.
50. $\frac{3\frac{1}{2}}{4\frac{1}{2}}$.

CHAPTER VIII.

CUBES, AND SUMS AND DIFFERENCES OF SQUARES AND CUBES.

70. To cube a number we must know the cubes of the first nine numbers, viz., 1, 8, 27, 64, 125, 216, 343, 512, 729 (which the student ought to notice all end in a different digit).

Since $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
$= a^3 + b^3 + 3ab\,(a + b)$.

Let us write any number, say 54, in the form of $50 + 4$.

$54^3 = (50 + 4)^3 = 125{,}000 + 064 + 3 \times 200 \times 54$
$= 125{,}064 + 32{,}400 = 157464$.

Conceiving the cubes of the smaller numbers as 001, 008, 027, 064, we can at once, as in the case of the squares, conceive 125,064, to which we have to add three times the product of the digits, multiplied by their sum.

71. Since $(a + b)^2 + (a - b)^2 = a^2 + 2ab + b^2 + a^2 - 2ab + b^2$
$= 2a^2 + 2b^2$

$$\therefore a^2 + b^2 = \frac{(a+b)^2}{2} + \frac{(a-b)^2}{2}.$$

$$= (a+b) \times \frac{a+b}{2} + (a-b) \times \frac{a-b}{2}.$$

or the sum of two squares = the sum of the numbers × half their sum plus their difference × half their difference—

e.g., $47^2 + 33^2 = 80 \times 40 + 14 \times 7$.
$= 3{,}298$.

72. If the sum of the two numbers is an odd number there is no advantage whatever in using this formula, and very little unless the sum of the units is 10.

73. Since $a^2 - b^2 = (a + b)(a - b)$.
The difference of two squares is equal to the product of the sum and difference of the numbers squared.

e.g., $47^2 - 34^2 = 81 \times 13 = 1{,}053$.

74. Since $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$.
$= (a-b)(a^2 + 2ab + b^2 - ab)$.
$= (a-b)[(a+b)^2 - ab]$.

The difference of the cubes of two numbers is equal to the square of the sum of the numbers less their product multiplied by their difference—

e.g., $37^3 - 33^3 = (70^3 - 37 \times 33)\,4$.
$= 3{,}679 \times 4$.
$= 14{,}716$.

75. There is a very much simpler way of writing down these differences. Find the arithmetic mean between 37 and 33, viz., $\frac{37 + 33}{2}$ or 35. Conceive $(37^3 - 33^3)$ as $(35 + 2)^3 - (35 - 2)^3$. If these cubes are expanded, and the terms collected, we should have $(35 + 2)^3 - (35 - 2)^3 = 2[3.35^2.2 + 2^3]$, the other terms cancelling one another.

$\therefore\ 37^3 - 33^3 = 14{,}716$.

76. I do not think the student need practice with any pairs of numbers the sum of whose units is other than 10.

77. Since $(a^3 + b^3) = (a + b)(a^2 - ab + b^2)$
$= (a+b)(a^2 - 2ab + b^2 + ab)$
$= (a + b)[(a - b)^2 + ab]$.

The sum of the cubes of two numbers is equal to the sum of the square of the difference of the numbers and their product multiplied by their sum—

e.g., $23^3 + 37^3 = 60\,(14^2 + 851)$
$= 62{,}820$.

78. Here again, as in 75, we may write $23^3 + 37^3$ as $(30 - 7)^3 + (30 + 7)^3$
$= 2\,(30^3 + 3.30.7^2)$
$= 2\,(27{,}000 + 4{,}410)$
$= 62{,}820$.

79. The remark in 76 certainly applies to the sum of two cubes quite as much as or more than to the difference of two cubes.

80. Since $(a + b)^2 + (a - b)^2 - 2a^2$
$= 2b^2$
$77^2 + 63^2 - 2.70^2 = (70 + 7)^2 + (70 - 7)^2 - 2.70^2$
$= 2 \times 7^2$
$= 98$.

81. It will be noticed that 7 is half the difference between the two numbers, and that the number the double of whose square is subtracted is the arithmetic mean between the two numbers whose squares are added. Hence the sum of the squares of this sum and difference of two numbers less twice the square of the arithmetic mean between the two numbers is equal to twice the square of half the difference between the numbers.

82. EXAMPLES VIII.

Write down the—

1.	Cube of 35.	7.	Cube of 1·19.
2.	,, 47.	8.	,, 7·7.
3.	,, 69.	9.	,, ·117.
4.	,, 112.	10.	,, ·199.
5.	,, 61.	11.	,, 2·98.
6.	,, 124.	12.	,, 39·7.

Write down the value of—

13.	$47^2 + 23^2$.	33.	$18^3 - 12^3$.
14.	$56^2 + 44^2$.	34.	$29^3 - 21^3$.
15.	$28^2 + 32^2$.	35.	$91^3 - 79^3$.
16.	$35^2 + 45^2$.	36.	$48^3 + 22^3$.
17.	$112^2 + 88^2$.	37.	$35^3 + 25^3$.
18.	$223^2 + 77^2$.	38.	$17^3 + 23^3$.
19.	$116^2 + 24^2$.	39.	$45^3 + 25^3$.
20.	$87^2 + 123^2$.	40.	$37^3 + 13^3$.
21.	$157^2 - 64^2$.	41.	$137^2 + 111^2 - 2 \times 124^2$.
22.	$87^2 - 35^2$.	42.	$68^2 + 56^2 - 2 \times 62^2$.
23.	$225^2 - 115^2$.	43.	$77^2 + 117^2 - 2 \times 97^2$.
24.	$56^2 - 6^2$.	44.	$66^2 + 44^2 - 2 \times 55^2$.
25.	$442^2 - 441^2$.	45.	$47^2 + 57^2 - 2 \times 52^2$.
26.	$137^2 - 84^2$.	46.	$137^2 + 117^2 - 2 \times 127^2$.
27.	$122^2 - 57^2$.	47.	$86^2 + 92^2 - 2 \times 89^2$.
28.	$148^2 - 48^2$.	48.	$142^2 + 92^2 - 2 \cdot 117^2$.
29.	$2{\cdot}7^2 - 1{\cdot}3^2$.	49.	$(\frac{4}{7})^2 - (\frac{3}{7})^2$.
30.	$\cdot 18^2 - \cdot 12^2$.	50.	$(\frac{1}{4})^2 - (\frac{1}{5})^2$.
31.	$27^3 - 13^3$.		
32.	$46^3 - 24^3$.		

(To be continued.)

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Hints to Pupil Teachers, &c.

WE propose in our paper this month to give a few general rules relating to Pupil Teachers' examinations.

And, first of all, it is of serious consequence to a pupil teacher that he should have so methodized his work under the directions of the master as to have the last two or three months of the year left him for careful revision of the subjects studied in the course of it. Apart from a weekly time table, such as we append, and which should serve as a guide to teachers in the distribution of time to the several studies required, the pupil teacher's syllabus should be sub-divided by the head teacher into three portions, the concluding one to be got through at the end of nine months. Three months will thus be left for revision. At the end of each period of three months there should be an examination, the papers carefully revised, and faults in them pointed out to the pupil teacher.

Where a Pupil Teachers' Examination Association is within reach, teachers would be very well advised in availing themselves of its advantages. Upon this subject we shall have something to say in a forthcoming paper, and we propose further to touch upon the indisputable benefits attending a modification of the central system of teaching. Now we should only desire to lay down a few rules relating to the Government examination itself. Where teachers are within easy distance of the examination centre, there will be no difficulty about attending it. But when once there it is important that precautions should be taken for a change in case of a wetting, and for the provision of a dinner in the interval between the morning

and afternoon sittings. But where teachers come from a distance, involving a very early start, at an hour when breakfast is not easily obtainable and is often unpalatable when obtained, it is, to our minds, a matter for serious consideration whether after all it is not much wiser for the teachers to travel to the centre the evening before. Where the pupil teacher is a girl, no doubt, there are great difficulties in the way of this arrangement. On the other hand, girls are much more likely to break down than boys owing to an unreasonably early start before their harassing examination. Indeed, it is the frequency of such breaks-down, some of which are within our recollection, affecting the after-health, and in one case costing the life of the pupil teacher, that has induced us to insist so strongly upon this matter. Be it remembered that managers would be perfectly entitled to charge in the school accounts for the extra expense attendant upon visiting the centre the evening before it. The examination room reached, pupil teachers should be careful to pay full attention to the instructions prefixed to their examination papers. These are briefly:—

1. The name of the school to which the pupil teacher belongs, and the pupil teacher's name should be written at the top of every paper. In this connexion it is clear that for a teacher to describe his school as St. John's, or St. Mary's, without naming the village or town in which it is situate, is an insufficient guide to the examiner.

2. The subjects are to be taken in order, and the number of the question answered prefixed.

3. There is no restriction as to the questions to be answered beyond the requirement that not more than a certain number of questions are to be attempted in certain subjects.

4. Giving or receiving improper assistance during examination will be visited by dismissal from the examination.

5. The examination papers cannot be taken away. The answers to them should be placed within them, but not, unless at the express desire of the inspector, pinned or fastened together.

6. The only articles which pupil teachers may bring into the examination room are paper, pens, ink, pencil, knife, indiarubber, and round ruler.

It is very important that teachers should make certain of getting two questions in arithmetic right, for this is one of the failing subjects. It appears first upon the paper, because it requires a clear head, and candidates should be exceedingly careful not to quit the arithmetic paper until they have proved two of the sums they have attempted to be correct. In view of the limited time allowed for the examination, pupil teachers would be well advised in working with a watch before them. We now proceed to append a set of arithmetical specimen papers in this most important subject. The conditions under which prizes are offered for the best answers upon them will be found in our next article.

Arithmetic.

FIRST YEAR.

FEMALES.

1. What is meant by the greatest common measure of two or more numbers?
Find the G.C.M. of 218707, 526769, and 695822. 37. Ans.

2. Find by practice the value of two pieces of land, each containing 22 ac. 3 rds. 30 poles, at £446 5s. 4d. for two acres.
£10236 4s. 10d. Ans.

3. Make out in proper bill form the following:—13½ yds. of calico at 1s. 4½d. per yd., 47 yds. of calico at 8½d. per yd., 2½ doz. pairs of gloves at 2s. 8d. per pair, five table-cloths at three guineas per pair, 25 reels of cotton at 1s. 6d. per dozen.
£14 12s. 5¾d. Ans.

4. A person spent ⅓ of his money, and then gave away ¼ of what was left. He then lent ½ of what still remained. What fraction of the whole had he remaining? ¼ Ans.

SECOND YEAR.

FEMALES.

1. What is the value of ⅘ of two guineas + ⅞ of 3s. 4d. + 1⅛ of a half sovereign + $\frac{4}{15}$ of 3s. 9d. + $\frac{10\frac{1}{2}}{24}$ of a groat.
£2 15s. 7$\frac{4}{15}$d. Ans.

2. Express as decimals $\frac{1848}{10000}$, $\frac{27}{1000}$, 1⅛, $\frac{1074}{4608}$, and $\frac{1}{64}$.
·1295, ·027, 1·6, 3·228, ·015873 Ans.

3. Simplify $1\frac{1}{2} + \frac{3\frac{1}{2} - \frac{1}{4}}{3\frac{1}{2} + \frac{1}{4}} - 2\frac{3}{5}$ of $\frac{1}{15} - \frac{8}{9} - 1\frac{3}{10}$. 1. Ans.

4. A factory has 120 windows, 80 of which contain 16 panes, each 15 inches by 12 inches, the remainder contain 12 panes, each 1 foot square. Find the cost of glazing the whole at 9d. the square foot. £78. Ans.

THIRD YEAR.

FEMALES.

1. Find the value of $\frac{\cdot1}{\cdot01} - \frac{\cdot01001}{\cdot001} + \frac{92\cdot7}{\cdot06} + \frac{99}{\cdot0009}$
111544·99. Ans.

2. Find the difference between 3·24 of £236 5s. and 3·24 of £236 5s. £1 1s. Ans.

3. If 7 oxen *or* 11 horses can eat the grass of a field in 37 days, in how many days would 5 oxen and 8 horses eat it? 25½. Ans.

4. How many oranges at £·084375 a dozen ought to be given for 378 eggs at ·0625s. each? 168. Ans.

5. Reduce 3½ in. to the decimal of 2 furlongs, and £2 11s. 6¾d. to the decimal of £5.
·00022$0\frac{5}{9}$, ·515625 Ans.

FOURTH YEAR.

FEMALES.

1. What is the discount on a bill for £793 14s. 10½d. due nine months hence at 4 per cent.? £23 2s. 4½d. Ans.

2. If the 3 per cents. are at 90⅛, what sum must be invested to secure an income of £340 after paying an income tax of 7d. in the £1. £10521$\frac{7}{13}$. Ans.

3. In how many years will £1501 5s. amount to £1763 19s. 4½d. at 3½ per cent. per annum. 5 years. Ans.

4. The retail price of a book is 5s. If the expenses of sale were 15 per cent. and the profits 25 per cent. on the cost price, what was the original cost of the book? 3s. 6¾d. Ans.

FIRST YEAR.

MALES.

1. If $\frac{7}{15}$ of a guinea be taken from $\frac{9}{16}$ of ⅝ of £5, what fraction of £3 9s. will remain. $\frac{1}{12}$. Ans.

2. Find the value in money of 2·375 gs. + ·109375 of £5 − 14·625s. £2 6s. 2¼d. Ans.

3. A, B, and C can do a piece of work in eight days. A, alone, can do it in 20 days, C in 24 days. What fraction of the whole can B do in nine days? $\frac{5}{72}$. Ans.

4. Simplify $\frac{3}{2 + \frac{7}{2 + \frac{3}{4}}} + \frac{5}{6 - \frac{5}{2 - \frac{4}{5}}}$ $3\frac{173}{180}$. Ans.

SECOND YEAR.

MALES.

1. At what rate per cent. will £5 amount to 5 guineas in 219 days? $8\frac{1}{3}$. Ans.

2. Find the gain or loss per cent. if eggs are bought for 16 a shilling and sold at 18d. per score? Gain 20 per cent. Ans.

3. If the Three per Cents. be at $92\frac{3}{4}$ and the Four per Cents. at $123\frac{1}{4}$, in which should one invest? and how much is one investing in each when the difference is 2s. 6d?

Four per Cents. £1143 2s. $10\frac{1}{2}$d. Ans.

4. In a dictation lesson given to 35 scholars, 14 had no mistakes, 8 had 1, 6 had 2, 4 had 3, 2 had 5, and 1 had 7. Find the average number of mistakes? $1\frac{1}{5}$. Ans.

THIRD YEAR.

MALES.

1. By selling a watch for £34 10s. there is a loss of 8 per cent., what would be the loss or gain per cent. if it were sold for £38. Gain, $1\frac{1}{9}$. Ans.

2. Find the discount on a bill for £612 17s. 6d. drawn July 12th at four months, and discounted September 3rd, at 5 per cent. £6 1s. $4\frac{44}{101}$d. Ans.

3. Find square root of (*a*) 7578747136
(*b*) $\frac{4}{9}$ to four decimal places.

87056. ·8451, &c. Ans.

4. A canal 20 miles long has an average depth and width of 10 ft. and 42 ft. respectively. How long would it take 100 men to excavate it, supposing each man to remove 15 cubic yards per day? $1095\frac{5}{9}$ days. Ans.

FOURTH YEAR.

MALES.

1. Sold goods for £225 10s. and gained thereby $12\frac{1}{2}$ per cent., how much would have been gained or lost by selling the same goods for £187 10s.? Loss, $6\frac{1}{4}$ per cent. Ans.

2. A B C have together £25. B has twice as much as A, and C has 16s. 4d. more than A. Required the share of each.

£12 1s. 10d. £6 0s. 11d. £6 17s. 3d. Ans.

3. £3070 3s. 3d. has to be divided between A B C so that A may have $\frac{5}{17}$ of B's share, and B $\frac{1}{3}$ of A's and C's together. Find their respective shares.

B £1364 10s. 4d. A £202 3s. $0\frac{4}{17}$d. C £1503 9s. $10\frac{13}{17}$d. Ans.

4. Which would be the more advantageous—to sell goods for £810 ready money, or for £830 to be paid nine months hence, the discount being at the rate of 5 per cent. per annum.

Ready money, by £10. Ans.

Algebra.

THIRD YEAR.

1. Resolve into factors
(a) $x^4 - x^2 - 110$. $(x^2 + 10)(x^2 - 11)$. Ans.
(b) $a^2 + b^2 - c^2 - d^2 - 2ab - 2cd$
$(a - b + c + d)(a - b - c - d)$. Ans.

2. Divide $x^6 - 3x^4y^2 + 3x^2y^4 - y^6$ by $x^3 - 3x^2y + 3xy^2 - y^3$
$x^3 + 3x^2y + 3xy^2 + y^3$. Ans.

3. A person paid a bill of £3 14s. with shillings and half-crowns, and gave 41 pieces of money altogether. How many of each were paid? 19 shillings 22 half-crowns. Ans.

FOURTH YEAR.

1. Solve $a\frac{a-x}{b} - b\frac{b+x}{a} = x$.

$a - b$. Ans.

2. Find two numbers in the proportion of 8 : 5, the product of which is 360. 24, 15. Ans.

3. A plantation in rows consists of 10,000 trees. If there had been 20 less rows there would have been 25 more trees in each row. How many rows are there? 100 or 80. Ans.

TIME TABLE FOR PUPIL TEACHERS.

DAY	SUBJECT	BOOKS	TIME
MONDAY ...	History	Green's History of English People	6.30 a.m. to 8 a.m. in Summer.
	School Management ...	Curtis's Outlines of School Management ...	
		Gladman's School Management	7 a.m. to 8.30 in Winter.
	Etymology	Curtis's Etymology	
TUESDAY ...	Arithmetic	Barnard Smith's Arithmetic	Ditto. Ditto.
	Algebra	Hamblin Smith's Algebra	
	Music	Hullah's or Curwen's Music	
WEDNESDAY	Grammar	Mason's Outlines of Grammar	Ditto. Ditto.
	Geography	Hughes' Class Book of Modern Geography...	
THURSDAY ...	Euclid, Mensuration ...	Pott's Euclid, or Galbraith and Houghton's...	Ditto. Ditto.
	Drawing	Exercises on Blackboard	
FRIDAY ...	Sciences, Recitation, and Reading	Miscellaneous, according to Subjects... ...	7 a.m. to 8 a.m.
	Needlework	Miss Jones' Work on Needlework	
SATURDAY ...	Examination of week's work	... ...	9.30 a.m. to 11.30 a.m.

Helps to the Study of Shakespeare's 'Hamlet.'

HAVING completed our annotation of the first scene in considerable detail as a specimen of what the thoughtful and intelligent student will be able, and will find it profitable, to do for himself, we quit for the present this particular form of aid which would demand too much space to be continued throughout the play, and which moreover is not necessary for teacher-students, as it may be for school children beginning the study of a Shakespearean play.

We proceed now to deal with the second scene in a way which we believe will afford valuable help to the student, by affording a model which he may imitate in dealing with succeeding portions of the play, by helping to clear up possible obscurities in grammatical relation of words and phrases, and by taking him a real step in the direction of rational paraphrasing.

We propose to give some of the speeches in complete prose order, using the words of the original, but supplying ellipses where necessary, adjusting grammatical inversions, and giving in brackets equivalents for such words and forms of speech as have become archaic, or present other special difficulty. We begin with the speech of the King to his assembled court.

Though the memory of the death of Hamlet, our dear brother, be yet green, and that (though) it befitted us (was seemly for us) to bear our hearts in grief, and our whole kingdom to be contracted in one brow of woe (to be drawn together in general mourning), yet discretion hath so far fought with nature that we think with wisest sorrow on (of) him, together with remembrance of ourselves. Therefore, we have taken to wife (wedded) our sometime (former, equivalent to Latin *quondam*) sister, now our Queen, the imperial jointress (joint possessor) to this warlike state, as it were with a defeated (disfeatured or disfigured) joy, with an auspicious (cheerful) and a dropping (tearful) eye, with mirth in funeral and with dirge in marriage, weighing delight and dole (dolour grief) in equal scale. And herein we have not barred (excluded) your better wisdoms (your wiser judgments) which have freely gone along with this affair. For all this we give our thanks.

Now follows that (what) you know already—young Fortinbras, holding a weak supposal of our worth (low opinion of our valour), or thinking our state to be disjoint (disjointed, upset) and out of frame by (through) our late dear brother's death, colleagued (coupled) with the dream of his advantage [*he* redundant] hath not failed to pester us with a message importing (having for its import) the surrender of those lands which were lost by his father to our most valiant brother with (according to) all bonds of law. So much for him (Fortinbras).

Now for ourself and for this time of meeting thus much the business is (this is the business): We have writ (written) to Norway (the King of Norway) uncle of young Fortinbras—who being impotent (sick or infirm), and bed-rid (bed-ridden, confined to his bed) scarcely hears of this purpose of his nephew—asking him to suppress (hinder) his further gait herein (progress in the matter) in that (inasmuch as) the levies, the lists and full proportions are all made out of his subject (people subject to him); and we here dispatch you, good Cornelius, and you, Voltimand, for (as) bearers of this greeting to old Norway (the old King of Norway); giving to you no further personal power to business (arrange the matter) with the King [more] than the scope of these delated articles (*either* articles written at length, *or* articles handed over to be conveyed) allow (allows). Farewell, and let your haste commend your duty (give proof of your doing your duty).

In this speech should be noted the following grammatical points: the use of plural form *our* for *my* as customary expression of regal dignity, and particularly the form *ourself*; *sometime*, an adverb used as adjective; plural form of abstract noun *wisdoms*; old use of *that* for *what*, or *that which*, in 'that you know;' the contracted forms of passive and complete participles, as *disjoint* for disjointed, *writ* for written, *bed-rid* for bed-ridden; superfluous repetition of subject *he* for Fortinbras, excused by the remoteness of the original subject from the verb; and the occurrence of plural verb *allow* with singular subject *scope*, a common idiom in Shakespeare in cases where the interposition of a plural noun, as *articles*, seems by a kind of attraction to influence the grammatical relationship. The words *jointress*, *supposal*, and *colleagued* do not occur elsewhere in Shakespeare.

The student should not fail to notice the formal and artificial character of this speech of Claudius. Its carefully turned and set phrases with frequent antitheses may be regarded as typical of the King's style.

The next speech may be similarly treated.

We doubt it nothing (not at all): heartily farewell

And now, Laertes, with is the news with you? You told us of some suit (request); what is it, Laertes? You cannot speak of reason (with reason, or of any reasonable thing) to the Dane (the King of Denmark) and lose your voice (speak in vain); what wouldst thou beg, Laertes, that shall not be my offer, not (rather than) thy asking (request)? The head is not more native (naturally allied) to the heart, the hand is not more instrumental (serviceable) to the mouth than the throne of Denmark is to thy father. What wouldst thou have, Laertes?

The points to be noticed in this speech are the word *nothing* used adverbially, and the change from *you* to *thou*. The latter seems to imply more direct and personal application of the words, the former is used in more general utterances. Dr. Abbott says '*Thou* is often used in statements and requests, while *you* is used in conditional and other sentences where there is no direct appeal to the person addressed,' and he further observes on this passage that 'the King, as he rises in his profession of affection to Laertes, passes from *you* to *thou*, subsequently returning to *you*.' It has been suggested that the King may have been indebted to Polonius for help in securing the succession to the throne.

In Laertes' reply the construction is direct and simple, and no point calls for special note except the occurrence of the nominative absolute in the phrase 'that duty done.'

In the first speech of Polonius '*my slow leave*' means 'my leave slowly given,' and *laboursome* is for laborious. It is a hybrid word, the root being Latin, and the affix English.

The words in which the King dismisses the suit of Laertes express his wish that Laertes may enjoy his holiday, that time may be at his disposal, and that his best graces (accomplishments) may employ it for his pleasure.

'My cousin Hamlet, and my son.'—The word 'cousin' had a more extended meaning than its ordinary modern meaning, being applied to uncle, aunt, nephew, or niece, that is, generally, to collateral blood-relations. In this sense its derivation has been traced to Latin *consanguineus*, related in blood; but some regard the word as a condensed form of Lat. *consobrinus* for *consororinus*, a mother's sister's son.

A little more than kin, and less than kind.—This bit of word-play implies that Hamlet considers his mother's marriage has given him an additional relationship to Claudius, but has lessened the friendly feeling between them.

I am too much i' the sun.—Several meanings have been attached to this remark. Farmer sees in it a pun referring to the previous words of the King, 'and my son.' Hunter thinks it expresses his disapproval of the prevalent 'sunshine of jollity' in the court so soon after his father's death. Others regard it as a reflection on his being debarred from the succession, and so like an outcast sent out from his home into the sun, that is the open air.

Nighted colour, referring to the dark mourning robe and the sad aspect. *Denmark*, for King of Denmark. *Vailed lids*, eyelids cast down. Mark the use of *particular* in opposition to *common*, and on the reflection that loss is common, compare Tennyson's expression of the same thought in 'In Memoriam,' vi.:

> 'That loss is common would not make
> My own less bitter; rather more;
> Too common! never morning wore
> To evening, but some heart did break.'

The earnest speech in which Hamlet deprecates the use of the word *seems* in connection with his grief is simple and direct in its grammatical construction. *Inky cloak* refers to nighted colour; *suspiration of forced breath*, sighing; *dejected haviour of the visage*, downcast expression of countenance; *denote me*, express my feelings; *passeth show*, surpasses, goes beyond the possibility of being indicated; *trappings and suits*, outward garments.

'Tis sweet and commendable, &c.

commendable is accented on first syllable.

father lost—here 'lost' is passive participle attributive to 'father.'

the survivor bound—'bound' according to Dr. Abbott is elliptical for 'was bound;' but Hunter suggests inversion 'bound the survivor.'

obsequious—befitting a funeral, is derived from Lat. *ob*, and *sequor*, I follow, *obsequies* coming through a secondary meaning is applied to funeral rites.

persever has accent on second syllable.

condolement—grief.

incorrect to heaven—unsubmissive, unsubdued.

any the most vulgar thing to sense—a very unusual construction, meaning 'anything most common in the range of our observation or experience.'

fault to heaven—offence against heaven.

who—the personal relative is used with antecedent 'reason' by a sort of personification.

corse—a poetical contraction from *corpse*, dead body.

till he—'he' is ungrammatical, as 'till' is here used as equivalent to the preposition 'to.' The conjunctional meaning in 'till' may partially excuse the construction.

unprevailing—for unavailing.

most immediate—literally 'with no one coming between.'

impart—is a transitive verb, but is here used without an object directly expressed; various suggestions have been made to complete the sense; Theobald would make 'no less nobility of love' the object by adding 't, it, after 'with;' Johnson would understand 'myself' after 'impart'; but the most reasonable suggestion is that 'love' is intended to be the object.

school in Wittenberg—Before Shakespeare's time Wittenberg had become famous through Luther; but it is an anachronism to refer it to the time of the play.

retrograde—contrary; 'retrograde' has already been mentioned as one of the words springing from the belief in astrology.

Bend you—'Bend' is used as a reflexive verb, incline yourself.

chiefest—the superlative termination is needless, as chief in itself implies most important; but the superlative form is perhaps more emphatic.

lose her prayers—pray in vain.

in all my best—with my best endeavours.

sits smiling to my heart—rests close to my heart, and gives me pleasure.

in grace whereof—as gracious proof of which.

Denmark drinks—again means the King of Denmark drinks.

great cannon—This reference constitutes another anachronism, as cannon were not employed till long after the time when the events in the play are supposed to have happened.

the King's rouse—drinking bout. Staunton says *rouse* is undoubtedly the Danish *ruus*, a surfeit of drinking, or a deep draught, though here it possibly applies to some joyous shout accompanying the revelry.

bruit, the French *bruit*, noise, here used as a verb. Shakespeare also uses the word as a verb.

In these later speeches of the King notice the same artificial character as marked the first—the formal stilted language, the use of long and uncommon words derived from Latin rather than simple English. The references to drinking suggest the reputation of the Danes as a very intemperate nation in the time of Shakespeare.

too too solid flesh—The repetition of 'too' implies special emphasis and intense feeling. Halliwell has shown that in the earlier English writers *too-too* was often used as a compound word in the sense of exceeding.

resolve itself—dissolve or melt away, the literal meaning of the Latin *resolvo*.

canon 'gainst self-slaughter, religious law against suicide, this is contained in the sixth commandment. Certain philosophers among the ancients did not hold this opinion. The word 'canon' is derived from Latin *canna*, a reed, then a measuring cane, then a rule or law especially on ecclesiastical matters. The word 'cannon' which occurs in the preceding speech is derived from the same root, but its special meaning as a gun for throwing projectiles is based on its resemblance to the reed in being hollow. It may be interesting to notice that the words *ordinance*, a rule,

and *ordnance*, artillery, are similarly cognate words derived from the same root *ordino*, I order, the second being through the French *ordonnance*, applied to companies of archers banded under special rules, and afterwards to the military engines that superseded them.

uses of this world—usages, customs of the world.

possess it merely—occupy it exclusively; 'merely' is used in the sense of solely or absolutely.

that was, to this, Hyperion to a satyr—that was compared with this one as Hyperion compared with a satyr. 'Hyperion' has the accent on the second syllable. The Latin and Greek place it on the third. Hyperion is one of the Greek names for Apollo, and is here identified with the sun. 'A satyr,' a sylvan god, part man, part beast, typifying a coarse sensual nature, the god Pan.

beteem—permit. Some editors have changed this to 'let e'en,' which gives the sense very nearly. Another meaning belongs to the word beteem, namely, to 'pour out,' and there may be a trace of that meaning in this instance.

or ere—two forms of the same word, hence tautological. Compare with 'an if.'

Niobe, daughter of Tantalus, King of Lydia, who became mother of many sons and daughters, of whom all but one fell victims to the anger of Apollo and Diana, who were offended by Niobe's insolence to their mother Latona. According to the myth she was struck dumb with sorrow, and turned into a rock from which tears always flow.

wants discourse of reason—lacks the power of reasoning, that is comparing and deciding.

Hercules—the god typifying physical strength and endurance.

left the flushing—the likeliest meaning seems to be left off producing redness, but the editors of the Clarendon Press edition connect the meaning with the idea of filling with water.

galled eyes—eyes sore with weeping; 'galled' means irritated as by chafing.

post with such dexterity—to hasten with such speed.

nor it cannot—an instance of the double negative, often used by Shakespeare and other old writers with an intensive force. In later writers two negatives are mutually destructive, and form a stronger affirmative.

The student cannot but notice the earnest emotional character of this soliloquy as compared with the artificial speeches of the King. The words are simple, and for the most part pure English, but the construction is broken, elliptical, and disjointed, the flow of ideas and the rush of feelings seem too rapid to find formal utterance.

I'll change that name with you—The meaning suggested in the Clarendon Press Edition—'you shall be my friend and I will be your servant,' seems less likely than 'I'll exchange with you the name friend rather than servant.'

What make you—An old English idiom for 'what are you doing'?

truster—believer.

it followed hard upon—it followed closely; 'upon' is used as adverb.

Thrift, thrift, Horatio—It was economy, Horatio: the remains of the feast provided for the funeral served cold for the celebration of the wedding This is Hamlet's sarcastic way of referring to the haste with which the wedding followed the funeral.

dearest foe—my worst enemy. Dear was not applied exclusively in an affectionate sense, but was 'used of whatever touches us nearly in love or hate, joy or sorrow.'

or—ere.

methinks—impersonal verb, 'it seems to me.'

He was a man, etc.—This sentence is loosely constructed; the relation of the clauses appears to require that the last should be 'Upon whose like I shall not look again.'

Who?—grammar requires 'whom.'

Season your admiration—Moderate your wonder.

an attent ear—an attentive ear.

may deliver—have time to relate.

dead vast— silent empty time; dead probably refers to the quietness and seeming lifelessness of a dark night, 'vast' is used as a noun equivalent to 'waste,' of which it is indeed another form with the meaning emptiness.

Arm'd at point exactly, cap-à-pé—Armed completely at all points from head to foot; from French *cap-à-pied*.

distill'd almost to jelly—melted or softened; only occasion of this use of the word in Shakespeare.

These hands are not more like—to complete the ellipsis add 'each other, than the apparition and your father.'

it head— 'its head.' In Shakespeare's time the form 'its' was only just beginning to be used for the possessive of the neuter pronoun *it*: 'his' was generally used, but Shakespeare and other writers often used 'it' for the possessive. The form still belongs to some provincial dialects.

did address itself to motion—began to move.

like as—as if.

he wore his beaver up—he had the front part of his helmet up from his face; 'beaver' is derived from Latin *bibere* to drink, through old French *bevere*; it was raised by the wearer when he wished to drink. Another suggested etymology is French *bavière*, a bib.

constantly—steadily, firmly.

Very like—very likely.

tell a hundred—count a hundred. This the original meaning of the word 'tell' remains in some of its derivatives as *toll*, *tale* (complete number), *teller* (in banks) *all told*.

warrant—was written 'warnt' as it is still pronounced in the midland counties.

should gape—Staunton suggests that 'gape' here may mean yell, roar, or howl, rather than yawn or open. Still the latter meaning is quite a possible one. Compare 'Ye rude slaves, leave your gaping' in Henry VIII., iv., 1.

Let it be tenable—Let it still be kept as a secret: tenable is not used elsewhere by Shakespeare.

your loves—another instance of a plural form of an abstract noun, where the reference is to more than one person.

Your loves, as mine to you—Hamlet courteously prefers the word 'love' to 'duty,' as in his greeting he preferred 'friend' to 'servant.'

I doubt some foul play—I fear, suspect some wicked deed.

In the conversation with Horatio, observe the intense feeling shown by Hamlet in his short elliptical remarks and questions.

Query Column.

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ **When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher, Pilgrim Street, Ludgate Hill, London, E.C.*

Mensuration.

1. NIGER.—The radius of the base of a cylinder is 16 inches; a piece is cut off by two planes inclined to the axis of the cylinder, which do not meet each other; the length of the portion of the axis between the two planes is 35 inches; find the area of the curved surface.

The area of the curved surface will be the same, whatever the inclination of the planes may be.

∴ Area of curved surface

$= (16 \times 2 \times 3{\cdot}1416 \times 35)$ sq. in.

$= (50{\cdot}2656 \times 70)$ sq. in.

$= \underline{3518{\cdot}592}$ sq. in. Ans.

Algebra.

1. H. M.—For what value of m will the equation $2x^2 + 8x + m = 0$ have equal roots? (*Todhunter.*)

Let α and β denote the roots of the equation $ax^2 + bx + c = 0$;

$$\left.\begin{aligned} \text{Then, } \alpha + \beta &= -\frac{b}{a} \\ \alpha\beta &= \frac{c}{a} \end{aligned}\right\}$$

In the given equation the roots are equal:—

$$\left.\begin{aligned} \therefore 2\alpha &= -\frac{b}{a} = -\frac{8}{2} = -4 \\ \alpha^2 &= \frac{m}{2} \\ \alpha &= -2 \\ \alpha^2 &= 4 \end{aligned}\right\}$$

$$\therefore \frac{m}{2} = 4$$

$$\therefore m = \underline{8}.$$

2. DUNELM.—In how many ways, all different, can a volunteer shooting at a target score 16 in 9 shots; a bull's eye counting 3, a centre 2, an outer 1, and a miss 0? (*Potts'* 'Elementary Algebra.')

Score of 16 can be made up in the following ways:—

$(3 \times 5) + (1 \times 1) + (0 \times 3)$ = 1 way;

$(3 \times 4) + (2 \times 2) + (0 \times 3)$
$+ (2 \times 1) + (1 \times 2) + (0 \times 2)$
$+ (1 \times 4) + (0 \times 1)$ } = 3 ways;

$(3 \times 3) + (2 \times 3) + (1 \times 1) + (0 \times 2)$
$+ (2 \times 2) + (1 \times 3) + (0 \times 1)$
$+ (2 \times 1) + (1 \times 5)$ } = 3 ways;

$(3 \times 2) + (2 \times 5) + (0 \times 2)$
$+ (2 \times 4) + (1 \times 2) + (0 \times 1)$
$+ (2 \times 3) + (1 \times 4)$ } = 3 ways;

$(3 \times 1) + (2 \times 6) + (1 \times 1) + (0 \times 1)$
$+ (2 \times 5) + (1 \times 3)$ } = 2 ways;

$(2 \times 8) + (0 \times 1)$ = 1 way;

$(2 \times 7) + (1 \times 2)$ = 1 way;

∴ Total number of ways = 14. Ans.

3. FOLKESTONIAN.—The first term of a geometrical series is 1, and any one term of the series is equal to the sum of all that follow it, if continued ad infinitum; required the series.

Let the series be represented by a, ar, ar^2, ar^3,...

The sum of the series ad infinitum commencing at the second term

$$= \frac{ar}{1-r};$$

$$\therefore a = \frac{ar}{1-r}$$

$$1 = \frac{r}{1-r}$$

$$1 - r = r$$

$$2r = 1$$

$$\therefore r = \tfrac{1}{2}.$$

$$\therefore \text{Series} = \underline{1, \tfrac{1}{2}, \tfrac{1}{4}, \tfrac{1}{8}\ldots}$$

General.

1. R. FISH.—Prove that $\sin^2 2x - \sin^2 x = \sin x . \sin 3x$.

The following is a simpler solution than the one given last month:—

$$\sin^2 2x - \sin^2 x = (\sin 2x + \sin x)(\sin 2x - \sin x)$$

$$= 2 \sin \frac{3x}{2} \cos \frac{x}{2} \times 2 \cos \frac{3x}{2} \sin \frac{x}{2}$$

$$= 2 \sin \frac{3x}{2} \cos \frac{3x}{2} \times 2 \sin \frac{x}{2} \cos \frac{x}{2}$$

$$= \underline{\sin 3x . \sin x}.$$

2. J. MILLS.—Your solution is quite correct and very neat. You will notice that we have made use of it.

3. EXCELSIOR.—Not so irksome and rigorous perhaps, but men need to be up to the mark to make their way. You can get all information by applying to their agency for the colony, Victoria Street, Westminster, S.W. We advise you to acquire some manual dexterity before going out. Handicraft is coming to the front.

4. G. H.—*Rushbrooke's* 'First Greek Reader' is published by the Clarendon Press (Macmillan & Co.). If you want a word for word translation we cannot help you, except to tell you that such so-called translations are worthless. Translations can rarely be word for word; to be good for anything you must find equivalents for those in the author. Candidates are asked to translate the passages into good English. Our advice is either use a good translation or none at all.

5. LULU.—Yes, the writing is very fair, and would certainly not cause you to be rejected.

6. SUBSCRIBER.—The large hand is very bad. Before sending us writing to value you should try to imitate correct copies. You never saw the letter P in a large hand copy written as you have written it. The small hand is much better, and promises well. It is too stiff and upright, and the curves are not smooth; the edges are jagged. Large hand, 30; small hand, 80. The abbreviations allowed are such as ∴, ∵, =, AB.BC, for the rectangle contained by AB and BC. You must not employ symbols for operations such as √, or ×, or +, or −.

7. ECILA.—(*a*) Large hand: Your hand evidently trembles, and is not steady when forming the down stroke. Whilst the letters are fairly well shaped, the character of the strokes is bad, and some of the curves are defective. The small hand is in much better style. Here again there is evidence of an unsteady hand. Nothing but considerable practice will cure this fault. Upon very close inspection nearly every joining is distinctly visible, on account of an abrupt ending to the up stroke. (*b*) Large hand: You hold the pen wrongly. It is evidently used toward the left, instead of towards the right; the shapes are poor; the curves are not sufficiently rounded, and the joinings invariably in the wrong place. The strokes are steady. You need carefully to study the proper shapes of the letters. Small hand: Here again the pen is held wrongly. The letter *g* is written three times, and in each case is written differently. The essential of good handwriting is uniformity. Frequent practice from a good model is what you want.

8. VERITAS.—We do not know enough of the society you name to warrant us in giving an opinion. In all such cases it seems to us best to have recourse to well established societies. These you are doubtless well acquainted with; if not, we could give you information.

9. A. L.—Geometrical conics is a subject on which there are very good books. Try Richardson's 'Geometrical Conics,' published by Rivington & Co. But you need not get that if you have any other which covers the course.

10. HANNIBALL.—*Smith's* 'Compendium of Mercantile Law' is now out of print. *Stephens'* 'Digest of Criminal Law' is published by Macmillan & Co., price 16s., fourth edition.

11. LUMENARUM.—You do not ask for more than the percentage of marks you would probably get. I., 65; II., 70; III., 75.

12. J. L.—A good history for your purpose is Davies. Get any century you want. You would find some excellent reading in *Gervinus'* 'Lectures on Shakespeare.' You can consult it in any of the public libraries. 'Roger de Coverley,' by *Salmon* (Longmans & Co). You had better read the syllabus so far as history is concerned.

13. UNCLE B.—You have not said what you want us to do. We therefore merely estimate the separate specimens:—1, 60; 2, 50; 3, 50.

14. C. H. P.—Can you mention any instances of the transference of the *n* of the indefinite article to the beginning of the following noun. (*January Matriculation*, 1887.)

Nonce is a case of such transference = for the once. The *n* belongs to the article, and represents the *m* of the dative of the article. Other cases are newt, for an eut, just as nuncle, for mine uncle. You can refer to 'A Manual of Our Mother Tongue' (Hewitt), page 640.

15. A. B.—*might*—Aux. verb., sign of the potential mood.
have—Aux. verb., sign of perf. tense.
been—Past part. of irreg. verb 'to be.'
killed—Past part. of trans. weak verb to kill.
might have been killed—Verb trans., weak, pass., potential, pluperf., 1st pers., sing., agree. with its nom. I.
evening—noun used as an adj., qual. lake.
reflected—Past. part. of trans. weak verb 'to reflect,' qual. 'isle.'
is—Verb., irreg., indic., pres., 3rd pers., sing. Agrees with 'he.'
watching—Pres. part. of trans. weak verb 'to watch.' Qual. 'he.' Or 'is watching' can be parsed as the progressive form of the verb 'to watch.'

'Sir Roger de Coverley,' by *David Salmon*, published by Longmans, Green & Co.

16. DUFFER.—Yes, you must take up all the four authors you name. There are some excellent editions of *Bacon's* Essays; among others *Abbott's* and *Storr's*. There are cheaper editions, many of them very good. We cannot at present mention a really good article on the last educationist you name.

17. LITTLEHAMPTON.—The really classical book on the subject is *De Morgan's* 'Principles of Arithmetic.' You could not do better than study it. It is not a large book.

18. NERO.—We don't understand what you want us to do. Do you propose to send us the names and the marks? What means do you suppose we have of discovering the one or the other?

Arithmetic.

1. A. J. C.—A gardener had a number of shrubs to plant in rows; he tried 10 in each row, then 12, and afterwards 15, but had always 9 plants left. On trying 13 he had none left, what is the smallest number of shrubs he could have had?
(*Longman's* 'Modern Series Arithmetic.')

L. C. M. of 10, 12, and 15 = 60;
∴ No. will be a multiple of 60 + 9;
We therefore require a multiple of 60, which will leave a remainder of 4 when divided by 13;
Now, $\frac{60}{13}$ gives a remainder of 8;
$\frac{60 \times 2}{13}$,, ,, 3;
$\frac{60 \times 3}{13}$,, ,, 11;
$\frac{60 \times 4}{13}$,, ,, 6;
$\frac{60 \times 5}{13}$,, ,, 1;
$\frac{60 \times 6}{13}$,, ,, 9;
$\frac{60 \times 7}{13}$,, ,, 4;
∴ Smallest No. of shrubs = 420 + 9 = 429. Ans.

2. HANNIBAL.—A druggist takes a fluid ounce of a drug and dilutes it with 9 times its quantity of water supposed to be pure. He takes an ounce of the mixture and dilutes it again in the same proportion, and repeats the operation a third time. He afterwards finds that the water, which he had supposed pure, had been previously mixed with the same drug in the proportion of 99 : 1. What difference will this make in the strength of the mixture? (*Lower Division, Civil Service.*)

Amount of drug in 9 oz. of water
$= \frac{1}{10}$ oz.;
∴ Increase of strength in 1 oz. of mixture (1st time)
$= \frac{1}{1000}$ oz.;
,, ,, (2nd time)
$= (\frac{1}{1000} + \frac{1}{10000})$ oz.;
,, ,, (3rd time)
$= (\frac{1}{1000} + \frac{1}{10000} + \frac{1}{100000})$ oz.;
$= \frac{111}{100000}$ ozs.;
∴ Strength of mixture will be raised from $\frac{1}{1000}$ to $(\frac{1}{1000} + \frac{111}{100000})$ or $\frac{211}{100000}$.

Science Notes.

MR. V. G. EATON says that in the Eastern cities of the United States fully 30 per cent. of the men over thirty years of age show unmistakable signs of baldness, while fully 20 per cent. are already very bald. His observations seem to have been carefully made and upon a large scale. Bald-headed men he found to be most plentiful in New York and Boston, and only a little less so in Philadelphia and Washington.

A CORRESPONDENT asked some time ago, in *Nature*, if any one would inform him how to generate ozone in a room, cheaply and conveniently. It appears that there is no means in use at present for conveniently converting the oxygen of the air into ozone by means of electricity. A cheap and easy way of obtaining ozone is to mix three parts of strong sulphuric acid with two parts of permanganate of potash. Mr. Wise has pointed out that this can be done in a jam pot and the vessel put where it is wanted. Ozone will be given off from the mixture for some weeks.

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THE International Congress called together by the French Government to obtain a photographic chart of the heavens, has already met and made a promising and satisfactory beginning. The Congress considered that the progress realized in astronomical photography rendered it absolutely necessary that the astronomers of the present century should undertake the joint photographic record of the heavens; that the work should be undertaken at certain selected stations and with instruments identical in all essential points. The principal objects which the astronomers hope to accomplish are to record the general state of the heavens at the present time by determining the position and brilliancy of all the stars down to a certain magnitude; the magnitudes to be expressed according to some photographic standard to be hereafter determined, and to fix upon the best means of utilising the various data furnished by photographic data up to the present time.

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A MOST interesting series of experiments upon the liquefaction of gases has lately been carried out by M. Olszewski. He has succeeded in liquefying the so-called permanent gases at ordinary atmospheric pressure by the aid of excessively low temperatures. These were obtained by surrounding the tube in which the gas was to be liquefied with liquid Ethylene. This was allowed to boil by reducing its pressure and thus by its sudden conversion into vapour to produce intense cold. A temperature of — 150°C. was reached and ascertained by means of a hydrogen thermometer. The gas to be liquefied was then introduced in the tube under about 40—60 atmospheres and the liquefied gas then allowed to boil by reducing its pressures. In this way the boiling (or liquefying point) of oxygen at atmospheric pressure was found to be —181·4, of carbon monoxide —190. Professor Dewar has already ascertained that at these very low temperatures there is a great change in the chemical behaviour of bodies. Bodies which act upon each other with the utmost vigour at ordinary temperatures seem to be inert and sluggish when the temperature is so enormously reduced. At present, however, our knowledge of what goes on at extremely low temperatures is very limited.

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'SCIENCE' lately invited some eminent American authorities on Education to consider this question: What industry, if any, can profitably be introduced into *country* schools? Mr. S. G. Love, says that industrial or manual training opens a way to interest the children, to develop and employ their perceptive faculties, and to make the otherwise unattractive experiences of school life cheerful and pleasant. He thinks there are many things that can be done in any and all schools, and as soon as a pupil enters upon school life one of them should be taken up, and each carried forward one after another, just as the subjects of study are taken up and completed. But he does not specify what these subjects are, nor how they could be best taught, or even taught at all; whether to a few or to all the children, whether by an able teacher who is somewhat of a handy craftsman or by a competent workman, who is somewhat of a teacher. Mr. F. A. Walker proposes that approved methods of the Kindergarten should be carried upwards through the primary grades, that at the age of twelve or thereabouts there should be semi-weekly exercises with tools, preferably wood working tools, and in clay modelling, and that at the age of fourteen exercises in metal working should begin. Mr. C. H. Ham objects to the introduction of industrial features into courses of popular education in rural districts, partly because industrial training is very costly, but chiefly because children in the country learn so many things in their ordinary work and play that they do not seem to him to need any special industrial training at school. American authorities thus differ among themselves as to the value of manual and industrial teaching in country schools. It is of course quite true that country boys learn many things which town children do not. It has been well remarked, however, by M. Pamart in an article on this subject, that if the principles of agriculture are to be successfully taught we must begin with the children and begin in the school. The authority and general intelligence of the teacher will insure the assent of the pupils. They will believe what the teacher tells them and be willing to practise it. Adults like their own way and object to changes even when they are improvements. There is not likely to be any common agreement at present as to the exact mode of procedure in regard to the teaching of handicrafts. But there is a wide-spread conviction that something useful can be done and many are carefully considering how they can do it.

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SIR FREDERICK ABEL recently delivered a most able lecture on the work of the Imperial Institute which should be carefully read and some parts of it attentively studied by educationists. We quote a single paragraph. 'Switzerland,' says 'Sir Frederick, has often been quoted as a remarkable illustration of the benefits secured to a nation by the thoroughly organized education of its people. Far removed from the ocean, girt by mountains, poor in the mineral resources of industry, she yet has taken one of the highest positions among essentially industrial nations. Importing cotton from the United States she has sent it back in manufactured forms so as to undersell the products of the American mills. The trade of watch-making, once most important in this metropolis, passed almost entirely to Switzerland. The old established trade of Coventry has had to succumb before the skilled competition of Switzerland, and although she has no coal of her own, Switzerland is at least as successful as France in the appropriation of the coal tar industry. Comparative cheapness of labour will not go far to account for these great successes, they undoubtedly spring mainly from the thoroughly organized combination of scientific and practical education of which the entire people enjoys the inestimable benefit.'

Recent Inspection Questions.

Arithmetic.

STANDARD I.

1. 764 + 89 + 306 + 5 + 475. 1639. Ans.

2. Take 438 from 507. 69. Ans.

3. From 978 take 83. 895. Ans.

4. Mental arithmetic. Questions on tables only.

(*Another District.*)

1. 85 + 42 + 769 + 834 + 86. 1,816. Ans.

2. 460 — 95. 365. Ans.

3. Take 129 from 807. 678. Ans.

No mental arithmetic given.

STANDARD II.

1. Take 26,409 from 50,038. 23,629. Ans.

2. Divide 55,038 by 11. $5,003\frac{5}{11}$. Ans.

3. Divide 61,010 by 8. $7,626\frac{2}{8}$. Ans.

4. Multiply 17,434 by 97. 1,691,098. Ans.

(*Another District.*)

1. From 63,705 take 9,146. 54,559. Ans.

2. Multiply 7,863 by 79. 621,177. Ans.

3. Divide 63,432 by 8. 7,929. Ans.

4. Questions on tables: 25d.? 47d.? 85d.? 53d.? Two boys have a sovereign each; one boy spends 3s., the other gets 2s. given him; how much has one more than the other?

STANDARD III.

A.

1. Take 7,103 from 596,374, and divide the remainder by 289. 589,271 ÷ 289 = 2,039. Ans.

2. From one thousand and eight pounds take nineteen pounds and sixpence farthing.
£1,008 — £19 0s. 6¼d. = £988 19s. 5¾d. Ans.

3. Add £17 18s. 9½d., £604 10s. 7½d. £5,004 11s. 10½d., £6 19s. 11¾d., 15s. 2¾d.
£5,634 16s. 5¾d. Ans.

4. A man bought a horse and carriage. He gave £27 10s. 6d. for the horse, and £3 9s. 6d. more for the carriage than the horse. How much did he pay for both? £58 10s. 6d. Ans.

B.

1. Divide nine hundred and nine thousand four hundred and twenty-one by 426.
£2,134$\frac{337}{426}$ Ans.

2. From £5,000 10s. 4d. take 19s. 6¼d.
£4,999 10s. 9¾d. Ans.

3. Add £671 11s. 7d.; £5,374 19s. 6½d.; £217 15s. 7¾d.; £821 15s. 6¾d.; 16s. 11½d.
£7,086 19s. 3¼d. Ans.

4. A boy earned 1s. 10½d. in a day; a man earned 18s. 6d. in a week of 6 days. What does a man earn more than a boy in a week? 7s. 3d. Ans.

(*Mental Arithmetic.*)

How many pence in £1? Divide by 2. What do 50d. and 5s. make? Subtract 9s. 2d. from 10s. 6d. What is three times 1s. 6d.? How many pence would each of three boys have out of £1? Take 5s. 6d. and 7s. 6d. from £1.

STANDARD IV.

(*Boys.*)

1. Divide eight thousand and eighty-four pounds ten shillings and fourpence three farthings by 317.
£25 10s. 0¾d. $\frac{255}{317}$ Ans.

2. Reduce six hundred and five thousand and fifteen ounces to tons.
16 tons 17 cwt. 2 qrs. 13 lbs. 7 ozs. Ans.

3. What is the difference between 2,975 half-crowns and 5,083 florins? £136 8s. 6d. Ans.

4. How much can a man save out of an annual income of five hundred and thirty guineas if he spend £9 17s. 9¼ weekly?
£556 10s. — £514 4s. 1d. = £42 5s. 11d. Ans.

(*Girls.*)

1. Multiply £26 19s. 11½ by 37.
£998 18s. 5½d. Ans.

2. Divide six thousand eight hundred and one pounds ten shillings and eleven pence farthing by 97. £70 2s. 4½d. $\frac{27}{97}$. Ans.

3. How many yards in 1 mile 3 fur. 26 poles?
2,563 yds. Ans.

4. A tea dealer sells a number of six pound parcels at 3s. 3d. per lb., and receives £47 17s. 6d. for them. How many pounds of tea did he sell?
£47 17s. 6d. ÷ 3s. 3d. = 294$\frac{8}{13}$ lbs. Ans.

(*Mental Arithmetic.*)

If a ton of coal cost 25s. what is the value of 10 cwt.? Eggs are 9d. a dozen, what is the cost of 2? Of 1? If 2 cost 1½d., what will one cost? At ¾d. each, what is the cost of a dozen? How many pints in a gallon? In a barrel? What is $\frac{1}{8}$ of £1? $\frac{1}{3}$ of £1? What part of a £ is 2s. 6d.? How much is $\frac{1}{4}$ of £1? $\frac{1}{6}$ of £1?

STANDARD V.

(*Boys.*)

1. Make a bill for 15 articles at 4s. 11d., 12 at 2¾d.; 116 at 5½d., 12 doz. at 4s. 5d. a dozen, 10 at 3s. 4d. each. £3 13s. 9d. + 2s. 9d. + £2 13s. 2d. + £2 13s. + £1 13s. 4d. £10 16s. 0d. Ans.

2. Find the sum of $\frac{5}{8}$ and $\frac{1}{4}$, and the difference between $\frac{5}{8}$ and $\frac{3}{4}$, and add the two results.
$\frac{1}{8} + \frac{3}{8} = 1\frac{7}{8}$. Ans.

3. If £9 14s. 3d. be paid for 37 cwt. what will 102 cwt. cost?

37 : 102 :: £9 14s. 3d. : £26 15s. 6d. Ans.

4. What will it cost to lay new telegraph wires for 7 miles at 8s. 4½d. per yd. if the cost of labour be also 3s. 8d. per yard? (By practice.)

£7,417 13s. 4d. Ans.

(*Girls.*)

1. What will 421 articles cost at £4 10s. 6½d. each?

£1,905 18s. 0½d. Ans.

2. Make a bill for 25 yds. at 3¾d. per yd., 19½ at 6d. each, 3 doz. at 8¾d. each, 15 at 5 for 1d. (7s. 9¾d. + 9s. 9d. + £1 6s. 3d. + 3d.)

£2 4s. 0¾d. Ans.

3. Add ¼ to the difference between ½ and $\frac{1}{10}$.

$(\frac{1}{2} - \frac{1}{10}) + \frac{1}{4} = \frac{13}{20}$. Ans.

4. What will 2 bush. 1 pk. cost at £1 14s. 8d. per qr.? 9s. 9d. Ans.

STANDARD VI.

(*Boys.*)

1. What will £645 amount to in 7 years 2 months at 3½ per cent., simple interest?

£806 15s. 9d. Ans.

2. If $\frac{5}{14}$ of a ship cost £3,916 17s. 0½d., what will $\frac{25}{42}$ cost?

$\frac{5}{14}$: $\frac{25}{42}$ :: £3,916 17s. 0½d. :

£6,528 1s. 8$\frac{5}{6}$d. Ans.

3. A draper bought 198 yds. for £54 10s., and sold the whole so as to gain £9 7s. 4d. He sold 108 yards at 6s. 8d. per yd. At what price did he sell the remainder per yd.?

$\frac{£54\ 10s. + £9\ 17s.\ 4d. - £36}{198 - 108} = 6s.\ 3\frac{29}{45}d.$ Ans.

4. Simplify $(1\frac{7}{8} \times \frac{1}{8}) + 3\frac{5}{12} + (\frac{3}{5} \div 1\frac{1}{25})$.

$5\frac{431}{1080}$. Ans.

(*Girls.*)

1. If I spend $\frac{3}{5}$ of my money, and then have enough to buy 11 chickens at 1s. 7½d. each, how much had I at first? £2 13s. 7½d. Ans.

2. What will £425 amount to in 1½ years if lent at 4 per cent. per annum? £450 10s. Ans.

3. From £1 $1\frac{1}{14}$ take $\frac{3}{14}$ of a guinea, and reduce the remainder to the decimal of a £.

·846428571 Ans.

4. If 12 horses plough 11 acres in five days, how many horses will be required to plough 33 acres in 18 days?

				horses.		horses.
acres	11	:	33	:: 12	:	10 Ans.
days	18	:	5			

STANDARD VII.

1. If an article is bought at 18s. 9d. per lb., at what rate must it be sold per cwt. to gain 16 per cent.?

100 : 116 :: 18s. 9d. : £121 16s. Ans.
1 : 112

2. If ·75 of a piece of work cost £2, when labour cost 6½d. per hour, what will ·125 cost when labour costs 9¾d. per hour?

·75 : ·125 :: £2 : 10s. Ans.
6½ : 9¾

3. If 11 boys pay 9d. each, 35 pay 6d. each, 47 fourpence each, 50 twopence each, and seven go free, what is the average weekly fee per child?

$(9 \times 11 + 35 \times 6 + 47 \times 4 + 50 \times 2) \div 150$
$= 3\frac{11}{15}d.$ Ans.

4. The two long sides of a field are 6½ chains, the two short sides 3½ chains each. A carpenter puts a fence round at 1s. 8d. per foot. What is the cost?

20 ch. × 66 × 20d. = £110 Ans.

Dictation.

STANDARD I.

Earth, cloth, green, white, school, chalk, board, flowers, ink, pencil.

STANDARD II.

A.

They were going to cross a desert. A desert is a wild waste of land where there are few trees, hardly any grass or water, no houses, and few animals, but where there are almost everywhere rocks and stones, and sand—hot, shining sand, which hurts the eyes and burns the feet.

B.

And the children made trenches with their spades, and built up large sand heaps with the aid of buckets. But long before sunset the sea rose higher; it filled their trenches, and washed away their sand hills, and the whole party had to beat a rapid retreat. Higher and higher the sea flowed.

Geography.

STANDARD I.

What is a map? What is the good of a map? What is the top called? The bottom? Point to N. To S.E. To W. In what direction would you be looking at 12 o'clock at noon? Where do you see the sun in the morning? Where do you never see it?

(*Plan of School shown.*)

What corner is this? (N.W.) What is this? (Floor.) This? (Playground.) This? (Partition wall.) How many windows are there in the north wall? In what part of the school is this window? (S.W.)

STANDARD II.

(*Map of England before the class.*)

What is this? (Points to coast.) What do you mean by coast? What is the land bordering on a lake called? On a river? What kind of a place is

a source? Could you stop it with your hat? What is a lake? What is the opposite of a lake? What is this piece of land (pointing to a cape) called? Give other names for a cape? What is this black line (pointing to a river)? Where do rivers come from? Point out some mountains. What is a chain? A group? What is the wide mouth of a river called? Name a river with an estuary. What good are rivers? What is the top of a mountain called? The bottom? If a ship were sailing from —— to ——, in which direction would it be going? What wind would be favourable? What wind would not be favourable? (Several examples were given to last three questions.)

STANDARD III.

(*Test map of England before the class.*)

Name these capes (pointing to several.) These mountains (ditto.) Where do the South Downs end? What kind of cape is it? What difference is there between it and other capes? How high is it? What river is this? (Thames.) What county is this? (Pembroke.) This island? What county does it belong to? (Several islands pointed to.) What is this black spot? (Birmingham.) What is made there? What other towns are in the neighbourhood? What does each manufacture? Name a port. Show Liverpool. Where do ships go to from Liverpool? What is Leicester noted for? Northampton? What is made in London?

STANDARDS IV. to VI. Grouped.

(Work of Standard VI.)

What zones are there? How many torrid? Why so called? Point it out. If it were Midsummer Day here (pointing south of equator), where would sun be overhead? What are the productions of the torrid zone? What part of the United States produces cotton? Name a town noted for its export of cotton. Where does the Mississippi rise? Where does it flow? Its length? Where does Missouri rise? What is the length of the Rocky Mountains? Name the lowest part. Some other mountains in North America. What are the British possessions in Central America? Show Mexico. What is it noted for? Where is the St. Lawrence? What is it noted for? Which of the great lakes is American? Name the towns on its southern shores. What towns are on the St. Lawrence? What island is at its mouth? What peninsula is on the west side of North America? Which countries in America do English people like to live in? Why do they go to these countries? Give the productions of Australia. Of New Zealand. Of India. Of West Indies. What is the largest of the West Indian islands? Our largest island? What is it noted for? Name part of South America possessed by us. What other nations have parts of the same continent? What rivers form the Rio de la Plata? Where do we get sugar? Corn? Gold? Silver? Pepper? Why does not sugar production pay in England? What is obtained from sugar? If you travelled from Cape of Good Hope to Orange River, what would be the nature of the country? What good is the Orange River for commerce? What is this island called? (Madagascar.) Who have lately been interfering here? Name this island? (Mauritius.) What is it noted for? Who have made discoveries in Central Africa? Name the lakes of Central Africa. Is the Nile good for commerce? Why? Show Tanganyika. What is the difference between Victoria and Niagara Falls? What is the capital of Egypt? Of Nubia? Of Abyssinia? Of Cape Colony? What kind of a coast has Africa? What are the productions of Cape Colony?

—o—

Publications Received.

Bell, G., and Sons—
Little Nell. By Charles Dickens. (Bell's Reading Books.)
Questions for Examination in English Literature. By the Rev. W. W. Skeat, Litt.D.

Blackie and Son—
Euclid, Book 1. By A. E. Layng.
Home Lesson Book to Fourth Historical Reader.
Poynter's South Kensington Drawing Books. Nos. 1 to 6. (First grade.)
Poynter's South Kensington Drawing Books. Nos. 1 to 4. (Second grade.)
The Comprehensive Examiner. By David Clark.

Cassell and Co., Limited—
Geographical Readers. Standards II. and III.
Handbook of the New Code. By John F. Moss.

Curwen and Sons—
School Cantata: The Sons of Toil. By T. M. Pattison.

Johnstone, W. and A. K.—
The Threepenny Atlas.

Longmans and Co.—
Some National and Board School Reforms. Edited by Lord Brabazon.

Marcus Ward & Co.—
The Oriel Alphabet Sheets. Nos. 1 & 2.
The Oriel Geographical Readers. Standards VI. and VII.

Nutt, David—
Otto's German Grammar.
Vocabularies to do.
The Student's French Examination Papers. No. 17.

Parr & Knowles—
The 'Times' Inspectors' Arithmetical Questions. Standards II. to VI.
The Lancashire Series of Poetry Cards. Standards II. to VI.

Reid Bros.—
Music:—L'étoile d'amour.
Marguerite.
Gwendoline.
Elysian Dreams.
Cavatina in D.
He giveth His Beloved Sleep.

Sampson, Low and Co.—
Juvenile French Plays. By A. Porcher.
Chemistry for Beginners. By R. L. Taylor.

Smith, Elder and Co.—
The Cornhill Magazine. May.

Stanford, E.—
An Entymological Manual. By K. T. Best, M.A.

Sullivan Bros.—
Home Education. By Maurice C. Hime, M.A.

The Clarendon Press—
Elementary Trigonometry. By the Rev. B. Roach, M.A.

Christopher Columbus, by Lamartine.

TRANSLATED BY A. M. BOWER, F.R.G.S.,
Late Master in University College School, London.

CHRISTOPHE COLOMB.	CHRISTOPHER COLUMBUS.
PREMIÈRE PARTIE.	FIRST PART.

CHAPTER VII.

Son père, homme éclairé	His father, an enlightened man
et aisé dans sa profession,	and well-to-do in his profession,
ne résista pas à la nature	did not oppose the inclination
qui se manifestait	which showed itself
par de si studieux penchants	by such studious tendencies
dans son fils.	in his son.
Il l'envoya étudier	He sent him to Pavia
à Pavie la géométrie,	to study geometry,
l'astronomie, l'astrologie,	astronomy, astrology,
science imaginaire du temps,	an imaginary science of that time,
et la navigation.	and navigation.
Son esprit dépassa promptement	His intellect soon overstepped
les limites de ces sciences,	the boundaries of these sciences,
alors incomplètes.	at that time incomplete.
Il était de ces âmes	His was (one) of those minds
qui vont toujours	which always go
au delà du but où	beyond the point at-which
le vulgaire s'arrête	the crowd stop
et dit : 'Assez.'	and say : 'Enough.'
À quatorze ans il savait	At 14 years (of age) he knew
tout ce qu'on enseignait	all that they taught
dans ces écoles ;	in these schools ;
il revint à Gênes,	he returned to Genoa
dans sa famille.	to his family.
La profession sédentaire et inintellectuel	The sedentary and unintellectual profession
de son père ne pouvait	of his father could not
emprisonner ses facultés.	confine his faculties.
Il navigua plusieurs années	He sailed for several years
sur les navires	on merchant vessels and
de commerce, de guerre,	ships of war,
d'expéditions aventureuses,	on adventurous expeditions,
que les maisons de Gênes	which the mercantile houses of Genoa
armaient sur la Méditerranée	fitted out in the Mediterranean
pour disputer ses flots	to contest-the-mastery-of its waters
et ses ports aux Espagnols,	and ports with the Spaniards,
aux Arabes, aux Mahométans,	Arabs and Mahometans,
sortes de croisades perpétuelles	a kind of perpetual crusade
où le trafic, la guerre et la religion	where trade, war and religion
faisaient de ces marines	developed out of the navies
des républiques italiennes	of the Italian Republics
une école de commerce, de lucre,	a school of commerce, of gain,
d'héroïsme et de sainteté.	of heroism and of sanctity.
Soldat, savant et	Soldier, a man of culture, and
matelot à la fois,	sailor, at the same time,
il monta sur des vaisseaux	he embarked on vessels
que sa patrie prêta	which his country lent
au duc d'Anjou	to the Duke of Anjou
pour conquérir Naples,	in order to conquer Naples,
sur la flotte	on the fleet
que le roi de Naples	which the King of Naples
envoya attaquer Tunis,	sent to attack Tunis,
sur les escadres	on the squadrons
dont Gênes combattait l'Espagne.	with-which Genoa fought Spain.
Il s'éleva, dit-on,	He raised himself, it is said,
à des commandements	to the command
d'obscures expéditions navales	of obscure naval expeditions
dans la marine militaire	in the royal navy
de son pays.	of his country.
Mais l'histoire le perd de vue	But history loses sight of him
dans ces commencements	in these first beginnings
de sa vie.	of his life.
Sa destinée n'était pas là :	His life-work was not there :
il se sentait	he felt himself
à l'étroit	confined within narrow limits
dans ces petites mers	in these small seas
et dans ces petites choses.	and in these little affairs.
Sa pensée était plus grande	His thoughts extended far beyond
que sa patrie.	his fatherland.
Il méditait une conquête	He meditated a conquest
pour l'espace humaine,	for the (benefit of the) human race
et non	and not
pour une étroite république	for the diminutive republic
de la Ligurie.	of Liguria.

CHAPTER VIII.

Dans les intervalles	During the intervals
de ses expéditions,	between his expeditions
Christophe Colomb	Christopher Columbus
trouvait à la fois,	found at the same time
dans l'étude de son art	in the study of his profession
la satisfaction de sa passion	the gratification of his passion
pour la géographie	for geography
et pour la navigation,	and for navigation,
et son humble fortune.	and his humble fortune.
Il dessinait, gravait et vendait	He drew, engraved and sold
ses cartes marines :	his sea-charts ;
ce petit commerce	this little trade
suffisait péniblement	hardly sufficed
à son existence.	for his living.
Il y cherchait	He sought therein (in it)
moins le lucre	less for gain
que le progrès	than for the advancement
de la science.	of science.
Son esprit et ses sens,	His mind and his intellect
continuellement fixés	continually fixed
sur les astres et les mers,	on the stars and seas,
poursuivaient par la pensée	followed in thought
un but entrevue	a goal perceived
par lui seul.	by himself alone.
Un naufrage, à la suite	A shipwreck, after
d'un combat naval	a naval engagement
et de l'incendie d'une galère	and the setting on fire of a galley
qu'il montait	which he commanded
dans la rade de Lisbonne,	in the roadstead of Lisbon,
le fixa en Portugal.	detained him in Portugal.
Il se précipita dans la mer	He jumped into the sea
pour échapper aux flammes,	in order to escape from the flames,
se saisit d'une main,	seized hold with one hand
d'une rame, et,	of an oar, and
nageant de l'autre	swimming with the other
vers la côte,	towards the coast,
il atteignit le rivage.	he reached the shore.
Le Portugal, saisi tout entier	Portugal, carried entirely away
alors de la passion	at the time by the passion
des découvertes maritimes,	for maritime discoveries
était un séjour	was a home
convenable à ses inclinations.	suitable to his inclinations.

Notes.

CHAPTER VII.

Envoyer takes no preposition before infinitive. Disputer (see Dictionary). Monter un vaisseau = to command a vessel. Dont = with which (sing. and plur.).

Translate into French: The nature of his son was shown by his studious inclinations. Send him to London to study. Columbus disputed with the Spaniards (the mastery of) the sea and the ports. Columbus contended for the ports with the Portuguese. The soldier disputed the passage with the sailor. Columbus had the command of the ship. The squadron with which Genoa fought Spain, &c.

Grammatical Questions.

CHAPTER VII.

1. Account etymologically for the accent in école, étudier, âme, arrête, était.
2. Give the homonyms of 'fois' with meanings and etymology.
3. Write the feminine of ambassadeur, vengeur, pêcheur, governeur, serviteur.
4. 'Dans son fils.' Remark on the pronunciation of the word 'fils,' according to its different meanings.

(To be continued.)

—o—

The Musical Instrument (Violin) Maker of Cremona.

Scène III.	Scene III.
Filippo, Sandro, Giannina.	Filippo, Sandro, Giannina.
Filippo entre vivement au fond, referme brusquement la porte derrière lui, puis tout essoufflé :	Filippo enters hastily from the back, closes the door again abruptly after him, then quite out of breath :
Filippo.	
Ouf ! enfin, m'y voici ! Les petits gueux ! J'ai bien cru qu'ils allaient m'atteindre.	Ugh ! At last, arrived ! The little rascals ! I almost thought they would overtake me.
Giannina.	
Qu'est-ce donc, Filippo ? qui donc semblez-vous craindre ? Et qui donc vous poursuit ?	What is the matter, Filippo ? whom do you seem to fear ? And who then pursues you ?
Filippo.	
De méchants polissons Qui, s'armant de cailloux fort durs et de tessons, Ont voulu m'assommer.	Miserable urchins Who, arming themselves with very hard pebbles and rubble Intended to kill me.
Giannina.	
Vous ?	You ?
Filippo.	
[*Se touchant la tête.*	[*Feeling his head.*
A telles ensignes Que là, je sens au front ..... [*Montrant sa main.* Voyez plutôt.	The proof of it Is here, I feel on my forehead [*Showing his hand.* Look only.
Sandro.	
Tu saignes !	You are bleeding ?
Giannina.	
De l'eau...vite ! [*Elle va chercher sur une crédence un vase et une aiguière.*	Water.....quick ! [*She goes to fetch from a small side-board a jug and a ewer.*
Sandro.	
Dis-nous comment ceci t'advint.	Tell us how that happened to you.
Filippo.	
Ah ! parbleu, c'est bien simple. Ils étaient quinze ou vingt, Gâte-sauce, écoliers, un tas de rien qui vaille, A lapider un chien au pied d'une muraille, Un pauvre chien, aux yeux éteints, aux poils pendants Ayant la force au plus de leur montrer les dents, Infirme et se traînant sur sa patte brisée. En voyant cette bête ainsi martyrisée, J'eus le cœur soulevé d'un douloureux émoi ; Je croyais voir souffrir un humble comme moi. Bravement je m'élance au sein du populaire, En demandant pitié, j'excite la colère. Ah ! l'on ne songe plus à la bête, à présent. Lapider un bossu, c'est bien plus amusant ! Je me mets à courir, les traînant à ma suite J'enfile une ruelle, une autre, et, sans ma fuite, Ou m'eût assassiné, cela n'est pas douteux, Mais j'ai sauvé la vie au pauvre chien boiteux !	Ah ! by Jove, that is very simple. There were fifteen or twenty Scullions, school-boys, a lot of good for nothing rascals, Pelting a dog at the foot of a low wall, A poor dog, with eyes bedimmed and draggled hair, Having hardly the strength to show his teeth, Infirm and dragging himself along with his broken leg. Seeing this animal thus tormented, I felt deeply moved with grief ; I imagined I saw a humble being like myself suffering. Boldly I rush in the midst of the rabble, Begging for pity, I excite anger. Ah ! they no more think of the animal now. To pelt a hunch-back is far more amusing ! I begin to run, drawing them after me I bolt down a lane, another, and, without my flight, They would have killed me, there is no doubt about it, But I have saved the poor lame dog's life !
[*Il tombe épuisé sun un fauteuil.*	[*He falls exhausted on an arm-chair.*
Giannina.	
[*posant son mouchoir trempé d'eau sur le front de Filippo.*	[*putting her handkerchief moistened with water on Filippo's forehead.*
Ces vagabonds ! Vit-on jamais tant de malice ? Pauvre garçon !	The vagabonds ! Saw anybody ever so much malice ? Poor fellow !
Filippo.	
[*à part.*	[*aside.*
Sa main sur mon front ! O délice !	Her hand on my forehead ! Oh delight !
Giannina.	
Etes-vous mieux ?	Do you feel better ?
Filippo.	
[*si levant et d'une voix très-émue.*	[*rising, and with deeply moved voice.*
Merci, je n'ai plus mal.	Thank you, I am quite well now.
Sandro.	
[*à part.*	[*aside.*
Vraiment, C'est trop d'émotion pour un remerciment ! Je ne me trompe pas. Il l'aime !	Really, There is too much emotion for mere thanks ! I am not mistaken. He loves her !

(To be continued).

Notes of a Lesson on Rain and Rainfall.

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INFORMATION ARRANGED IN TEACHING ORDER.

A. Common experiences of clouds and of the particles composing them.

1. During a fog or mist the particles of moisture are observed to be very small.

2. When ascending a mountain travellers frequently pass into similar mists. These are the masses of cloud particles which hang round the summit and flanks of the mountain and hide these portions of the mountain from the view of the people below.

B. Why do clouds float?

The answer to this question may be made clear by the following considerations:—

1. We have seen that a cloud is composed of water particles: but since water is heavier than air, these water particles ought to fall immediately they are formed.

2. If the air were perfectly still the water particles would begin to fall through the atmosphere at once. This downward movement is hindered by two causes.

(*a*) The wind movement of air which carries the water particles in a more or less horizontal direction.

(*b*) The friction of the air upon the extremely large surface area which each particle possesses in comparison with its mass.

The proportion between the surface area and the volume increases with the lessening in size of each cloud particle.

ILLUSTRATIONS AND TEACHING HINTS.

1. These particles are often so small that the children will fail to distinguish them at first.

Refer to the collection of tiny globules of moisture on their clothing, or upon their hair when walking through a mist or fog.

When a very gentle breeze is blowing, the cloud particles are sometimes distinctly visible.

2. The case of Snowdon may be mentioned. Very rarely indeed is the ascent made without the traveller passing through a cloud. The summit is scarcely ever distinctly visible from below, on account of the clouds which envelop it.

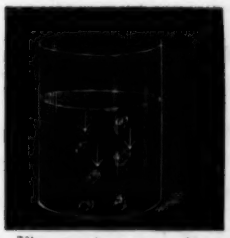


Fig. 1. Lumps of clay falling rapidly.

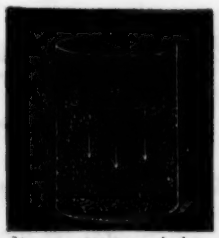


Fig. 2. Powdered clay settling very slowly.

1. Lead children to this notion by the following experiments:

Take a tumbler, Fig. 1, three-fourths full of clear water. Throw into the water small lumps of clay. The children state what they see: they further answer the question, Why do the lumps of clay fall at once to the bottom?

Take now a second tumbler, Fig. 2, similarly filled with water. Throw into it finely powdered clay and watch the result. The water remains cloudy for some hours:—Why? *Evidently because the particles are very small* **and for this reason continue to float.**

2. Put the muddy water aside, if perfectly still it will soon begin to clear, if stirred, however, it remains muddy.

(*a*) Illustrate by reference to the wind carrying clouds of dust although the dust particles are heavier than equal bulks of air.

(*b*) Show the change in the relation between surface area and bulk by means of the following illustrations.

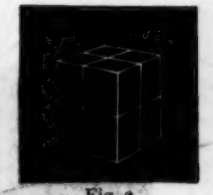


Fig. 3.

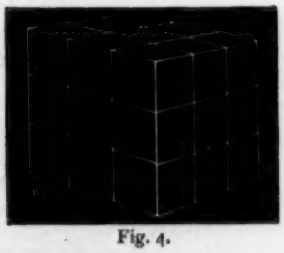


Fig. 4.

The larger (Fig. 4) possesses 27 cubic inches solid content and only 54 sq. inches of surface area, whilst the smaller (Fig. 3) possesses only 8 cubic inches solid content and 24 sq. inches surface area.

C. Change of cloud to rain.

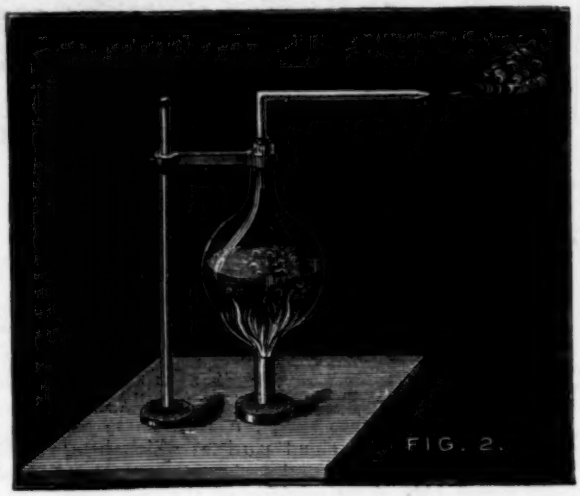
1. If the cloud particles remain suspended chiefly on account of their small size any means which serve to increase the size of the particles will also tend **to change the tiny water globules into rain drops.**

2. **Two modes of increase.**

(*a*) By the fine water particles running together.

(*b*) By the addition of moisture by condensation on the outside of the globule as it passes through air filled with moisture.

1. A simple inference from the calculation made above and one which the children will readily make.



Place a cold slate in front of the vapour particles issuing from the nozzle, Fig. 2, and allow the children to watch the increase in the size of the particles; a drop is soon formed which after joining other drops runs down the slate.

D. Mode of measuring the amount of rainfall.

Rain falling on the ground rapidly disappears in three ways, viz. :—

(*a*) By soaking into the ground.

(*b*) By running along the slopes into a neighbouring stream.

(*c*) By evaporation.

If we wish to ascertain how much rain falls upon a certain space we must have means which will prevent the escape of the rain by any and all of the three ways mentioned above.

An instrument constructed for this purpose is called a rain gauge.

Show a Rain-gauge if possible. If not, draw a diagram and direct attention especially to :—

1. A, the funnel used for collecting all the rain which falls on the space between B and C.

2. D, the can in the lower part which prevents the water from running away, and is of service also for taking out the water in order to measure the amount in the small vessel F.

3. E, the bend in the funnel made to prevent evaporation of the water in the can D.

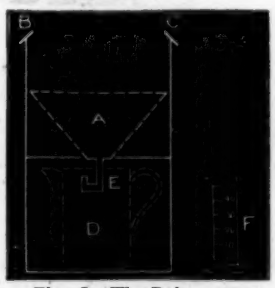


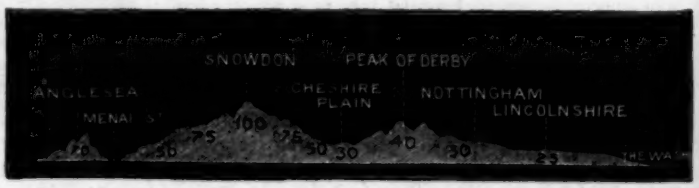
Fig. 6. The Rain-gauge.

The Teaching should now proceed by the application of the modes of cloud and rain formation already taught, to the particular districts, *e.g.*,

Examples of rainfall, contrasting regions of heavy rainfall with other regions of very little or no rainfall.

1. The west and south-west of England have a much heavier rainfall than the eastern districts.

2. The coast of Guiana on the east of South America has a rainfall of 300 inches annually whilst Peru on the west coast possesses a rainless district.



1. Show the diagram of rainfall across England and expect the children to state in answer to questions why the rainfall is heavier in the W. than in the E.

3. The rainfall on the Khasi Hill, a little north-east of the Ganges delta is the heaviest on record, viz., 500 inches annually; whilst the whole district of the Gobi, north of the Himalaya and Kuen Lun Mountains is almost rainless.

This heavy rainfall occurs during the S.W. Monsoon.

The Gobi is fringed with mountain ranges and is far removed from the sea. The winds have been robbed of their moisture by passing over the high land before reaching this rainless district.

2. Show the position of these places on the map, then state the nature and direction of the prevalent winds and leave the class to infer the character of the rainfall, *e.g.*,

(*a*) The winds over Guiana are from the Atlantic hence they are moist winds; they are also warm. Ask the children what will happen when they reach the hills near the coast of Guiana?

(*b*) In Peru the winds are from the W. and have become very dry in their passage over S. America and especially from being forced over the Andes range of mountains. Hence Peru contains a region of no rainfall.

3. Teach in a similar manner to that indicated in 2 above.

BLACKBOARD SKETCH.

1. Mists and Clouds are formed of
   very small particles of water.
2. These particles are prevented from rapidly falling by
   the friction of the atmosphere.
3. Raindrops are formed from the clouds in two ways
   (*a*) **By small globules running together.**
   (*b*) **By further condensation of moisture.**
4. The rain gauge measures exactly
   The amount of rainfall in any locality.
5.

Regions of Heavy Rainfall.	*Regions of Slight or no Rainfall.*
(*a*) West and S.-West of England and Wales.	(*a*) The eastern counties of England (slight).
(*b*) Coast of Guiana in S. America.	(*b*) A district in Peru (rainless).
(*c*) The Khasi Hills north-east of Calcutta. (Heaviest rainfall.)	(*c*) The Gobi or Great Desert in Central Asia.

Publications Reviewed.

The Schoolmaster's Calendar and Handbook of Examinations and open Scholarships, 1887. London: George Bell and Sons.

An admirable idea excellently carried out. To those teachers engaged in coaching pupils for the various public examinations (other than those connected with elementary education and the Science and Art Department) this handy little volume will come as a veritable boon. It contains in a convenient form what we have been asked for times out of number:—viz. 'a concise list of the various public examinations in which boys, and to some extent girls are called upon to compete.'

We strongly urge the editor when a new edition of his book appears to add the omitted lists we have indicated. We wish the 'Schoolmaster's Calendar' every success.

The London Matriculation Course. By John Gibson, M.A. London: Reeves and Turner.

The author follows the same plan as in the Preliminary Army Examination Course. The chief value to a student preparing for examination consists in the fifty pages of test papers and his ability to follow out the plan laid down.

Euclid's Elements of Geometry. Book I. Arranged by A. E. LAYNG, M.A. Blackie and Son.

This forms a volume of the publishers' well-known Elementary Text Books.

The peculiarities of the work, which deserve attention, and for which we recommend it, are:—

(1) Every proposition begins at the top of a page, and is concluded before the reader has to turn a leaf, so that the figure is always before the student as he reads or learns it.

(2) There are exercises and questions at the end of every proposition, with 100 miscellaneous exercises at the end.

(3) The notes, which are lucid, are appended to each proposition, and not collected at the end of the volume, where no lad and few teachers will ever look at them.

(4) The original lines of the figure, and the supplementary ones are of different thicknesses.

Abbreviations and symbols are used, but the author assures us that they are all allowed in the Cambridge Examinations.

At the end of the book there are worked out a good many examples, including some of the well-known problems as to certain lines passing through a particular point, and in the notes to the celebrated 47th there is an ocular demonstration of the theorem, which will serve as a puzzle for young students to give to their younger brothers and sisters.

The Eton Horace.
Part I. The Text.
Part II. The Notes on Book I. of the Odes. By F. W. Cornish, M.A. London: John Murray.

These parts are bound separately because, as a slip tells us, though 'boys should have the legitimate assistance of notes in preparing their lesson, yet when the lesson is properly learnt the notes should no longer be required.'

The portions of Horace's works here prepared are, the Four Books of the Odes, the Epodes, and the Carmen Sæculare.

The notes at present published only treat of the first book of the Odes, and as they fill no less than 50 odd pages, this second part, when completed, will in all probability be larger than the other.

Mr. Cornish, in his few words of preface, acknowledges the assistance he has derived from Orelli and Hirschfelder, as well as from Mr. Wickham.

At the commencement of the notes on each ode there is a very short paraphrase of the gist of the ode, and then the words and constructions, where needful, are explained. All historical and geographical allusions are clearly commented on, so that a student ought to have no difficulty with such help to prepare a lesson as an average schoolmaster would expect.

The Oriel Geographical Readers. Standards III. and IV. Edited by A. Traill, F.E.I.S. London: Marcus Ward and Co., Limited.

The editor of these books is the President for this year of the National Union of Elementary Teachers, and should have a good idea of what his fellow-teachers desire in a set of geographical readers. From the specimens now published he seems decidedly to have hit the mark. The features which strike us as specially marking these volumes are—first, the clear bold type in which they are printed, with names of places clearer still, and bolder: next, the easy, straightforward style, familiar in some places to colloquialism, in which they are written; then, the effective illustrations, and especially the coloured maps, many of which in the book for Standard IV. are printed in the midst of the letterpress; and lastly, the compact, but sufficiently full, summary at the end of the book for recapitulation and committing to memory. Many of the lessons in the book on England are most valuable on account of their tendency to encourage thought in the readers. Among such lessons may be named those on Manufactures, on Rural Occupations, Ship-building, England as a Trading Nation, Travelling in England. The chapters which are of a topographical kind appear in many instances to be the result of actual observation. For instance, the writer takes us on a tour round Scotland on a tricycle, and the description of the start has a strong savour of real experience, and the same may be said of the gossip by the way with the stone-breaker and the Dunbar fisherman. And, again, in a description of Dublin and Sackville-street, we read, 'The rain is beating down as we are passing from one object of interest to another, and we see at once why some one has called the city "dear, dirty Dublin." The ground under our feet is mainly composed of a soft clay, and the most trifling shower gives this substance an excuse for working its way up between the stones and showing itself.'

The simplicity and ease of the style in which these volumes are written fits them admirably for use in elementary schools, as children can hardly fail to be interested in the lessons. The writer has not lost sight of the fact that, if the matter of a book is to be interesting to its readers, its language must be fairly within their comprehension. Familiar writing is apt to deviate now and then from strict grammatical usage, and we notice one or two colloquialisms such as 'when they are done with it.' But on the strength of the merits we have mentioned we can sincerely recommend the Oriel Geographical Readers.

Selections from the II. Book of Kings. By the Rev. H. M. Clifford, M.A. Oxford University Press.

The very short preface of this book is very well done, and deserves special notice at the hands of the student.

The arrangement of the text and notes is this: the text is printed on the left hand of each page, and the notes to the right, the latter taking up more of the page than the former, and being in smaller type. Though the authorised version is printed in verses, as we usually find it, for some reason or other, which we cannot fathom, only some of the numbers of the verses are prefixed to them, *e.g.*, in the latter half of the first chapter we have the numbers printed at the beginning of the 11th, 17th, and 18th verses only.

The revised version corrections are all included in the notes.

In addition to such corrections, we have just the sort of information a young student wants to enable him or her thoroughly to understand the subject.

At the end all the texts in other parts of the Bible referred to in this 2nd Book of Kings are printed in full with a column showing where the reference is made.

There are also other useful tables naming the persons referred to, with the meaning of their names, as well as one of places, with lists of the Kings of Israel and Judah who flourished during this period, concluding with short discussions on such difficult matters as the Sun-dial of Ahaz.

We can understand the little book being quite as useful in preparing a class for examination as any other we remember to have seen.

Sir Roger de Coverley: Essays from the 'Spectator.' With Notes and Illustrations by David Salmon. Second Edition. London: Longmans, Green and Co.

It is gratifying to find that a work so well annotated as this collection of the de Coverley Essays, which we recently reviewed in this journal, has so soon reached the distinction of a second edition. And it is especially pleasing to notice that the publishers have felt themselves justified in re-setting the text in fresh bold type, so that the typography, which we found defective in the first edition, is worthy alike of the literary treasures it bodies forth, of the careful work of the editor, and of all the other admirable features which characterise the volume.

English Words Explained: An Aid to Teaching. By William L. Davidson, M.A. London: Longmans, Green and Co.

The careful student of language, whether he regards it simply as the means by which thought is expressed, or as an essential instrument of thought, cannot doubt that an accurate knowledge of the meaning of words, and a correct appreciation of distinctive shades of meaning, are helpful and indeed necessary to precision of thought, and also to its exact expression. Attention to this branch of study is important therefore to all who would think and speak or write with the force that comes of clearness and exactness. And to none is it more important than to the teacher who is able by precept and example to exercise so potent an influence on the thought, the speech, and the style of his pupils.

The little book named above is one we can heartily welcome as likely to afford to teachers of all classes real practical help on this matter. The author as a logician treats his subject with admirable clearness, and at the same time makes it interesting by his wealth of illustrations and examples. In an introduction to the book he points out the difficulties of accurate definition, the common errors made in attempting it, and the modes by which these errors may be avoided. Thus he calls attention to indefinable words, warns the student against attempting to define directly such terms as represent the simplest facts in nature

and the simplest experiences, and shows how these can nevertheless be clearly explained and practically defined by various devices, such as negative defining or defining by contrast, defining by examples, and defining by pictures or engraved illustrations. Then follows a section on synonymous discrimination, the value of which is very clearly explained and exemplified. Two rules are laid down as necessary to a just discrimination, first 'that the discrimination shall be *vital*,' second 'that it shall be *tersely* expressed.' The greatest stress is laid on the first of these rules, which is thus amplified: 'It means that only the *essential* point or points of difference be laid hold of,—in other words, that none but *salient* features be reproduced; all that is merely collateral, variable, or *accidental* being scrupulously excluded.' It is recognised, however, that any useful study of this subject must be founded on examples. Hence the body of the book consists of an alphabetical list of 'leading and important English words,' under each of which is arranged a group of words approximately synonymous, followed in every case by a paragraph which sets forth the vital distinctions in the words forming the group, and a series of sentences and quotations fully illustrating the proper use of each term.

The method will be best understood if we take one of these groups. Under 'CORRECT' we have the words, '*Accurate, Exact, Precise.* Accuracy is correctness regarded as mere *absence of mistake or error:* exactness signifies correctness in a more *positive* manner, and is *conformity to rule or requirement.* Precision is *scrupulous* exactness, or exactness *extending to minute details.* We call a writer "accurate" when his style is free from slovenliness and slipshodness: we call him "exact" when we view his style as conforming in general to the rules of the best composition; we call him "precise" when his exactness goes far towards being finical.' About a dozen sentences which follow exemplify the distinctions thus laid down.

To take another set, we have under 'MISTAKE' the words 'Error, Vice, Sin: Error is, strictly, a mistake of *judgment;* vice is a breach of *the moral law* or *conscience;* sin is a breach of *the law of God.* Error is a thing of the *head;* vice and sin are of the *heart:* error is *mental* or *intellectual:* vice and sin pertain to the *character.* We err through *ignorance;* we sin through *depravity.* The opposite of "error" is *truth;* the opposite of "vice" is *virtue;* the opposite of "sin" is *righteousness.* Vice is *ethical* or *moral;* sin is a *religious* term." A series of illustrative quotations follow, and may be used as an exercise on the paragraph.

An appendix contains passages chosen from four great masters of style, Johnson, De Quincey, Macaulay, and Carlyle; and these are subjected to a critical examination with a view to apply the method of the book to the study of style, so far as it depends on a proper use of words. It is then pointed out that the same degree of fulness is not needed in every lesson on discrimination. Certain points the teacher must determine beforehand: He must understand what words do not require to be explained: he should be alive to the propriety of demanding opposites: he must be aware of the cases where concrete examples are indispensable: and he must be conscious of the difference between verbal discrimination, and merely helping the pupil to extend the range of his vocabulary.

Such is a brief account of a book which teachers and students should find extremely useful.

Fifty Examinations in Mental Arithmetic. By a Head Master. Manchester and London: John Heywood.

Most of the simple rules of Mental Arithmetic are given in the first part of this little volume, which is a companion to other works of a similar character by the same author. Then follow fifty papers for the seven standards. To young teachers who find great difficulty in giving a mental arithmetic lesson, and as an independent test by the teacher, the volume will prove very useful. The questions are practical, free from eccentricities, and are supplied with correct answers.

Latin-English Dictionary. Revised, enlarged, and in part re-written by J. R. V. Marchant, M.A. Cassell and Co.

The publishers call this book after their own name—and perhaps with a firm which have done as much for education as they have, it is excusable to do so, but we are glad to be able to acknowledge by name the good work the compiler and editor has done.

Mr. Marchant is a scholar of no mean ability, and he shows it in every page of the work before us.

The dictionary is founded on the work of a German scholar—and what Latin-English dictionary of any value is not, whether published here or in America?—viz., Professor Georges, which was published at Leipzig in 1879.

The preface tells us that, as it is intended to be a Dictionary of Classical Latin, a large number of post-Augustan words have been omitted.

We are glad to notice that the work is a single work, and not two or three dictionaries bound together; in other words, the proper names, both of individuals and of places, are incorporated in the work, and the notices, both biographical and geographical, are fuller than we usually find in such works—the modern names of places being added.

The paper, binding, and printing being in Messrs. Cassell's usual style, and the price regulated on their well-known system of popularising works of real value, the volume ought to demand a large sale, to the advantage of education and scholarship.

Penley's Patent Pen-guide for Teaching and Improving Writing. London: E. Wolff and Son.

The chief desiderata in handwriting are that it shall be easy to read, rapidly written, and pleasing in appearance. To these many add that writing should be produced with the hand and fingers in a particular position; and, doubtless, as a rule, that penmanship is most legible, most rapid, and most graceful which is written with the hand in the position usually prescribed. We have, however, seen excellent writing produced by fingers holding the pen in a most clumsy and unorthodox fashion. Here, however, we have a contrivance which, by means of flanges forming part of the penholder, may constrain the pupil to place his fingers where the best authorities say they ought to be. One flange at the side of the holder, and extending below it forms a rest for the second finger, and another bending out sideways to the right keeps the second finger from bending too much, and forms a rest for the first finger. Other advantages claimed for this invention are that it gives the writer greater command over the pen, that it prevents the fingers from becoming cramped, and that, when not in use, it forms a pen-rest, keeping the ink from touching the desk or table. We have given it a trial and find the claim to these advantages justified.

First Latin Lessons. By A. M. M. Stedman, M.A. Geo. Bell and Sons.

We have had the pleasure of noticing more than one elementary work by this author, who is evidently also an experienced teacher. Mr. Stedman has undoubtedly gauged the boy mind pretty deeply, and knows how much, or rather how little, it can take in at a time. He would therefore give them at any single lesson but very little, and impress that little by much repetition and many exercises. He very wisely teaches accidence only as it is wanted. At the same time we are bound to notice that he enumerates all the eight parts of speech in the first page, when certainly two would have done, with which to form a single sentence.

Mr. Stedman, after showing the use of the nominative case, from which he starts, next teaches the use of the accusative, and then of the genitive, but after this he teaches the use of the other three cases altogether. The reader must notice that it is only the use of the cases

which has been taught up to this time, not how to form the Latin words. When Mr. Stedman gets to this he teaches the whole of a number of a single declension at once. We confess we prefer Arnold's plan of teaching all the accusative endings together, and then those of the other cases one by one.

Entire tenses too of the verbs are also given one by one in the middle of the nouns and adjectives, but though all the different forms of the verbs are collected at the end of the little work for reference—the lessons and exercises do not get as far as the use of the subjunctive mood.

We can well believe that with young children, or elder ones teaching themselves, the book would be found very useful as a slight beginning.

Miscellaneous Latin Exercises. By A. M. M'Stedman, M.A. Geo. Bell and Sons.

There are here no less than 143 exercises of well-graduated sentences, ten to each exercise. These sentences are selected from local and other examination papers, many of them being translations of short Latin sentences as found in the Classics.

Without a Key they would be of no use to one teaching himself, nor in fact to any teacher who was not a fair scholar. They are not classified, that is to say, we have not one exercise on the use of numerals alone, or another on the subjunctive with the relative, &c., &c., but every exercise may require the knowledge of the Syntax from one end to the other. We noticed one or two Latin sentences which were to be changed from the Oratio obliqua to the Oratio recta, or *vice versa*, and we think such examples might be increased in number with advantage.

The Elements of Euclid. Book the First. By James Martin. Geo. Philip and Son.

This edition, contained in 67 pages, consists of nothing but the text of Dr. Simpson's Euclid, without comment or assistance of any kind, except that the propositions are divided into their several parts of construction and proof, and that the supplemental lines of the figures, either for construction or proof, are dotted.

At the end there are some 66 exercises, which call for no remark.

Royal Star Arithmetics. Nos. 1, 2, 3, 4. London: T. Nelson and Sons.

The bright scarlet linen in which these little books are sewn gives them an attractive appearance, and on opening them we are struck not only by the neat arrangement of the hosts of examples they contain, but also by the very clear figures that are used throughout. The exercises are numerous enough for the teacher to vary the work of different pupils in a class, and are subdivided for that purpose. Tables are printed in each book, and in the one for Standard IV. a large number of mental exercises is given under the heading 'Drill.' The books are likely to share the popularity of other publications of the same series.

Cassell's Modern School Series. Poetry for Recitation, Standards I. and II., III. and IV., V. and VI. Series I. London: Cassell and Co.

These three little books contain a selection of short poems and poetical extracts suitably graduated for repetition by children in elementary schools. The pieces for the lower standards are marked by freshness, and those for the higher are from the best authors, witness the names Shakespeare, Milton, Scott, Gray. We notice, however, that hardly a single passage is long enough of itself to meet the requirements of the Code in Standards V. and VI.; so more than one would have to be used. Short and simple notes are appended where they seem necessary. The type and paper are good, and suitable illustrations are inserted.

The Story of Our Lord. By Frances Younghusband. London: Longmans, Green and Co.

This would be a handsome little gift-book for a boy or girl. It tells in a connected way the old old story narrated by the four Evangelists. Reverence for the subject of the narrative marks every page of the book, and a child would rise from its perusal with a clear idea of the beautiful life which it narrates. Engravings of pictures from the great masters, and illustrations from many sources are found on all the pages. We heartily commend the little volume.

Civil Service Arithmetic, with Answers and an Appendix. By John Keefe, F.R.G.S. London: Simpkin and Marshall.

A reprint of '39 sets' of Preliminary Questions for Men and Female Clerks, &c., has been published under the above title. It will be of use for practice to those intending to apply for admission to the Civil Service, and teachers may find here a variety of examples for their upper standards to work in a limited time. The type is too small for comfortable use.

Pupil Teachers' Geographical Year Book. First Year. Edinburgh and London: W. and A. K. Johnston.

This book contains all the maps, diagrams, and letterpress of the pupil teacher's first year's course in geography. It goes without saying that the maps are among the best of their kind, and the text is full and complete. The physical geography of hills and rivers is also illustrated by means of several coloured diagrams. To those who prefer the year's course distinct and separate from the work of future years the volume can be highly commended.

Musical Drill for Infants. By A. Alexander. London: G. Philip and Son.

The physical education of children receives more attention at the hands of teachers than formerly, and musical drill occupies a prominent place in the time table of many infant schools. Mr. Alexander desires to promote the health and recreation of children in the exercises contained in this book, which comprise calisthenics, swimming drill, rings, skipping and marching drill. Every movement is illustrated and the music is simple and agreeable. Wherever a school is supplied with a piano the use of this manual for systematic drill will be productive of marked success in the graceful movements, the health and enjoyment of the children.

Poynter's Drawing for the Standards. Eleven Books. London: Blackie and Son.

Messrs. Blackie and Son have published Poynter's Drawing Cards in a series of eleven books for the first four standards. They consist of selections from 'Dyce's Drawing Book' and numerous new designs. As they have been formed upon the exact model of the illustrated syllabus it will be easily seen that they are admirably fitted for preparation for the government examinations. We commend them as heartily as we commended the cards of which they are a reprint in a new form.

Script Letters for Perforating and Sewing. London: George Philip and Son, 32, Fleet-street.

This is a packet of twelve quarto cards with fly-leaf, one side being covered with script characters. It is intended that they should be used as an introduction to writing, the children pricking the fly-leaf through the letters on the front page, the copies of the letters thus made being worked with cotton, wool, or silk, and serving as an ornament or a copy to write from at home. We have grave doubts as to the utility of the cards in teaching writing, but the perforating and sewing would form an interesting occupation for infant school children.

Examples for Analysis. By P. Edwards. London: George Bell and Sons.

This pamphlet contains twenty-six pages of selections of simple, complex and compound sentences of varying lengths in prose and poetry from various authors. The sentences illustrate most of the grammatical difficulties of our language, and the selection shows considerable skill, but the price at which the pamphlet is published will prohibit its general adoption in elementary schools.

Vere Foster's Copy Books. Bold Writing Series. No. 13. London: Blackie and Son.

No. 13 of this Series is ruled as double small hand, the head lines being geographical facts concerning towns in the British Isles. The writing is bold and clear, and has the same characteristics as in the other books of this series. The capitals are plain, and the words are written without taking the pen from the paper.

Thom's Drawing Series for the New Code. By F. Wilkinson. Dublin: Alex. Thom and Co., Limited, Abbey-street.

Seven packets of this series are to hand, and we can speak in terms of the highest praise of all the seven. The cards in the packet for Standards I. and II. are printed on both sides—on one the copies are white on a black ground, and on the other black on white ground, and consist chiefly of common objects of right-lined forms. The packet for Standard III. has geometrical figures and curved freehand outlines on opposite sides. Standard IV., freehand, consists almost solely of the easier examples given in the old first grade examinations, while the more difficult examples are reserved for Standard V. The drawing to scale and geometry for Standards IV. and V. consist of questions for solution, the latter being accompanied by a sheet of the solved examples in solid geometry. The printing is clear, the questions are practical, and the series one requiring only to be known to be appreciated.

Ablett's Drawing Copies. Books 8, 10 and 12. London: Blackie and Sons.

These books are worthy followers of the preceding numbers of the series. They deal with the drawing to scale and geometry of Standards IV.—VI. They contain a great number of examples clearly worked out, the directions being simple and exact. The Government syllabus is much too extended for the short time at the disposal of the teacher for this subject, but if it can be accomplished it will be by the aid of such admirable books as these provided by Mr. Ablett.

Longmans' Handbook of Geography. Book 7. London: Longmans, Green and Co.

This is meant to accompany the geographical reading book of the same publishers' series. It contains several maps in black and white, the value of which is somewhat impaired by the too deep marking of the ocean currents. The letter-press consists of a clear synopsis of the geography of the ocean, the planetary system and the phases of the moon.

A Manual of Practical Solid Geometry. By William Gordon Ross. Cassell & Co.

This little work of 64 pages is specially prepared for military students and draughtsmen, its author being the Professor of Geometrical Drawing and Fortification at Woolwich.

Major Ross is wise enough to acknowledge the peculiar difficulty of the subject he would teach. In the career of a mathematical student, it has been noticed, there are three obstacles to his progress he has to penetrate, and one of these is that of the elementary principles of solid geometry, both theoretical and practical. The difficulty experienced mainly arises from the fact that it is only a practised eye and imagination which can see the relative position of lines and points when supposed to be in two or more planes.

Though the object of the work is to thoroughly explain orthographic projection, with its modification known as the 'system of vertical indices,' still we cannot help thinking that had the author used radial or perspective projection a little more in his illustrations of the definitions, axioms, &c., with which the first few pages are filled, the student would grasp the idea that the author would impart more quickly. True, the Major suggests that the student should get sheets of glass, cardboard, &c., for ocular assistance, but a good deal could be taught by shaded pictures, and so time saved. To quote what the author says :—

'The actual constructive operations based on these considerations, and required of the draughtsman, although simple enough, are sufficiently confusing to the beginner. This circumstance is due to the difficulty experienced by most in exercising what may be called the pictorial imagination. To carry in the mind's eye a continuous picture of the constructions used and the results obtained during the working out of a problem is a faculty possessed by none in perfection, although in the case of some individuals it is more largely developed than in the case of others. By practice and cultivation it may be induced where wanting, and in all cases it is capable of being developed and improved.' After this a note is added to the effect that 'No two persons can be treated alike by the instructor in his efforts to develop this most essential power, which has been termed the pictorial geometrical imagination. The use of models is absolutely necessary to enable some to comprehend illustrations and problems; but there are others who will more quickly, and to a greater degree, exhibit this faculty if they are permitted to use models only rarely.'

After 29 pages of definitions and axioms, there are 25 problems worked out by the index system of projection, but we are afraid very few, without further assistance, would be able even to follow, much less reproduce them, or others of a like kind. We then have four pages on Isometric projection and two on shadings, the little volume concluding with hints and suggestions for draughtsmen, with nearly 60 examples for practice.

In conclusion we cannot help thinking that the author in his desire to be brief has gone too far, and that more room might be given to the definitions and axioms with, as we said before, many pictures drawn in perspective for the purpose of explanation, though not, of course, for that of imitation in performing the problems. Even after a problem has been solved by the methods described here, a student would like to know what he has solved, and we fear many, at times, scarcely do know what the actual problem is at which they have been at work.

The whole subject of projections, even of plane figures, is one that has not yet been sufficiently handled and popularized, and Major Ross assures us that there was no work of the kind we have here, within the reach, that is, of the many; and we cannot help hoping that this work will be quickly followed by another, in which a little more space is devoted to the elements of this science.

To an experienced teacher we can well believe that the work would be a useful one to put into the hands of his class, and one likely to afford both him and them valuable assistance.

British Empire Atlas. Manchester and London: John Heywood.

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London: David Nutt.

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Owing to pressure on our space we are reluctantly compelled to hold over till our next issue 'Easy Steps in Trigonometry,' by the Rev. A. D. Capel, M.A.

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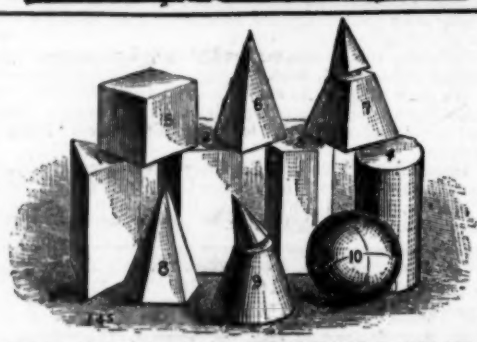

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